This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests and other presentations, together with editors' comments The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

The editors will exercise care in checking on the accuracy of data printed, but in all other respects articles and opinions of which expression is allowed are the opinions of their authors—the editors reserving in all cases the right to comment on the same, in the current or any subsequent issues, as they may be inclined.

The Journal of Occupational Diseases and Traumatic Surgery

The Science, the Law and the Economics of Industrial Health

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General Motors Corporation Medical Conference

—Flint, Michigan, May 19 and 20, 1938—

THE MEDICAL CONFERENCE of General Motors' Physicians, held at Flint, Michigan, May 19 and 20, 1938, had the following program:

Thursday, May 19:

MORNING SESSION: Subject, "Diseases of the Lungs;" Chairman, M. R. SUTTON, M.D., Medical Director, Buick Motor Division, Flint, Michigan.

1. "Experiences with the Use of Amorphous Silica," J. S. LAMBIE, M.D., Medical Director, Fisher Body Division, Pontiac, Michigan.

2. "Preventive Measures in the Use of Crystalline Silica," M. M. SHAFER, M.D., Medical Director, Frigidaire Division, Dayton, Ohio.

3. "Tuberculosis in Industry with Special Reference to Silicosis," W. J. MCCONNELL, M.D., Metropolitan Life Insurance Company, New York.

AFTERNOON SESSION: Subject, "Health Maintenance;" Chairman, W. S. WILLIAMS, M.D., Medical Director, Fisher Body Unit No. 1, Flint.

4. "A Cooperative Effort in the Control of Tuberculosis," R. D. MUDD, M.D., Medical Director, Chevrolet Grey Iron Foundry, Chevrolet Transmission Plant, Saginaw, Michigan.

5. "A Plan for Health Maintenance," HENRY SNOW, M.D., Medical Director, Delco Products Division, Moraine Products Division, Dayton, Ohio.

6. "Sickness in Industry," R. B. ROBSON, M.D., Medical Director, General Motors of Canada, Ltd., Walkerville, Ontario.

EVENING SESSION: Chairman, C. D. SELBY, M.D., Medical Consultant, General Motors Corporation, Detroit.

7. "Present Status of Disease in Industry," R. R. SAYERS, M.D., Senior Surgeon, U. S. Public Health Service, Washington, D. C.

8. "Medical Research in Industry," C.F. KETTERING, Director GM Research Laboratories, Detroit.

Friday, May 20:

MORNING SESSION: Subject, "Trauma;" Chairman, MAX BURNELL, M.D., Medical Director, AC Spark Plug Division, Flint.

9. "Safe Use of Trichlorethylene and Other Degreasers," A. L. BROOKS, M.D., Medical Director, Fisher Body Division, Detroit.

10. "New Method for the Treatment of Industrial Backs," FRED IRWIG, M.D., Medical Director, Chevrolet Motor Division, Kansas City, Missouri.

11. "A Conservative Method for the Treatment of Carpal Fractures," HAROLD WOUGHTER, M.D., Assistant Medical Director, Chevrolet Motor Division, Flint.

12. "The Prevention and Treatment of Industrial Neuroses," N. E. ECKELBERRY, M.D., Assistant Medical Director, Consolidated Edison Company of New York and Affiliated Companies.

AFTERNOON SESSION: Subject, "Special Problems;" Chairman, L. H. CHILDS, M.D., Medical Director, Chevrolet Motor Division, Flint.

13. "Medicine — The Guide and Measure of Safety," WM. J. FULTON, M.D., Medical Director, Fisher Body Division, Chevrolet Motor Division, Baltimore, Maryland.

14. "The Control of Lead in Duluxing and Finishing Operations," G. L. BIRD, M.D., Medical Director, General Motors of Canada, Ltd., Oshawa, Ontario.

15. "Dermatitis from Cutting Oils and Compounds," A. A. TOWER, M.D., Medical Director, New Departure Division, Meriden, Connecticut.

With the single exception of Dr. McConnell's address on "Tuberculosis in Industry with Special Reference to Silicosis," (No. 3, on the preceding page), which was not previously reduced to writing, all of the papers, in full text, with tables and illustrations, are included here, beginning on this page and continuing to page 516, in the order of their places on the program:

Experiences with the Use of Amorphous Silica

John S. Lambie, M.D.,
Medical Director,
Fisher Body Division,
Pontiac, Michigan

THE presumptive hazard with which we are concerned is in the form of silica known as tripoli. This is the main ingredient of the paste which is used to put the final high lustre polish on automobile bodies. Because of the high silica content in tripoli, the material has been under suspicion for some time although no cases of silicosis have been found from its use, or from processes employed in its production.[1] If men engaged in excavating, grinding, screening and handling the raw material do not get silicosis it would appear that tripoli mixed with oil and grease would not cause the disease. Had it not been that the diagnosis of "silicosis" has, in many cases, turned out to be a "racket" rather than a disease probably there would have been no interest in further pursuit of the subject.

The outcome of my investigation has yielded negative results. However, I have felt my efforts were worth while as I have determined that no one with active tuberculosis shall be engaged in this work.

In addition, the investigation has left a good psychological effect on the men examined as it has convinced them that an attempt is being made to safeguard their health in a dusty trade. So the work I have done has not been in vain.

This report might well terminate the article, yet because the subject of silicosis is still in the threshing-out period so to speak, because the wheat has not fully been separated from chaff, a review of our experiences may be of interest.

The Product: The polishing paste used in our plant contains a high percentage of tripoli.

There are several forms of this. The one which we use is obtained from large deposits in southwestern Missouri. Some producers of abrasives claim that while they use other siliceous deposits variously termed diatomite, diatomaceous earth, infusorial earth, kieselguhr and tripolite, these are all synonymous.[2] The original deposits had varying proportions of lime and silica, which accounts for differences in their present physical properties. Also some deposits may be contaminated with crystalline silica in the form of chert which largely destroys their commercial value.

Tripoli is an amorphous silica that originated as a deposit in the form of a colloidal gel —the siliceous remains of diatoms. When deposited many alkaline salts were probably present, and these being more readily soluble were gradually removed by percolating surface waters, leaving behind this unusual soft friable and porous form of silica. It contains 97% SiO_2 with fractional percentages of iron, alumina, lime, etc. From an analysis at the Massachusetts Institute of Technology there is less than 2% free silica in the form of quartz.

When a pulverized specimen of tripoli is viewed under the high-power miscroscope small masses with irregular rounded edges appear. The characteristic symmetrical shapes found in crystals are absent, but a few refractive minute particles suggest that with a higher degree of pulverization and magnification some extremely minute crystals might be found, hence tripoli has been called "crypto crystalline." However, it is generally considered an amorphous silica.

The Process: This method of polishing cars was commenced in Pontiac on the 1930 model and has been in use therefore eight years. The manner in which the polish is used is well known. The paste is dabbed on the painted surface and then subjected to the action of an electrically driven polishing wheel which is covered with sheep skin. The wheel rotates at the rate of 1800 revolutions per minute. The surrounding air contains large pieces of paste thrown off by the wheel as well as a finely divided dust. In our plant this process is not carried out in booths. About 250 linear feet of conveyor line are used and, at peak of production, 89 wheel polishers are employed.

The Problem: The amount of dust in the air was computed first in December, 1936, using a small portable dust counter. Seven counts were made showing 50 million; 44 million; 54 million; 53 million; 60 million; 59 million; and 70 million particles per cubic foot—average 56 million. The average size of the particles in finely pulverized tripoli is between 4 and 5 microns. In the dust found in the air the average is even smaller. The amount of SiO_2 in the dust was estimated at 40%.

The dust hazard being dependent on the quantity, quality, and size of the dust particles involved, plus the length of exposure, it was but natural that after receiving this report we were somewhat disturbed.

Our first concern was to protect the men by the use of respirators. But our anxiety for their health was apparently not shared by the men themselves and none of them seemed to wish to be troubled with a respirator. The only other protection afforded them was from three exhaust fans placed in the roof, and the efficiency of these was open to question.

After trying out several types of respirators it seemed wise before using compulsion to examine the men by x-ray to determine whether either silicosis or tuberculosis existed among them.

(NOTE: Later studies with the Greenberg-Smith impinger showed an average dust count of two million per cubic foot.)

THE TEST: Flat x-ray films were made of the 89 men exposed to the dust in this operation. The films were courteously reviewed by Dr. J. E. Church, a roentgenologist of Pontiac, and in no case could a frank diagnosis of silicosis be made. No tuberculosis was found.

Due to the fluctuations in production the 89 men had been exposed varying lengths of time to the dust; 25 had been exposed approximately seven to eight years; one for six years; two for five years; one for four years; 18 for three years; 30 for two years and 12 for one year or less.

The periods of exposure, might be criticized as being scarcely long enough on most of these men to cause silicotic changes in the lungs, or it might be assumed that they are in the first stage of silicosis which is difficult to diagnose. Pancoast and Pendergrass[3] point out the difficulty of diagnosing silicosis in its first stage by means of the x-ray, and their remarks on the caution that should be exercised are so important that I will quote at length from their article. After remarking on the "prominence and extent of the hilar shadows," "increased prominence and thickening of the trunk shadows," and "greater prominence of the linear markings of the peripheral zone due to engorgement of the peribronchial and perivascular lymphatics and cellular proliferation and fibrosis along their courses toward the pulmonary lymph nodes," they remark that "these appearances are not characteristic of pnuemonoconiosis but can be normal variations in the healthy adult chest or can be due to a large number of other causes," and "we wish to emphasize, that these appearances *alone* should *never* form the basis of a diagnosis of pneumonoconiosis, unless they have been found to have definitely increased within a period of a very few years by serial examinations, and the exclusion of other conditions in the interval which could have caused them. For the diagnosis of the first stage of pneumonoconiosis we would require one or two additional appearances; one is a slight haze in the mid-lung field, or a faint nodulation in the same locality or both—the haze is due to interstitial changes and the mottling to beginning nodular changes, both of which are indicative of pneumonoconiosis in most instances."

I gladly leave it to experts to argue over the roentgen findings of first stage silicosis. As industrial surgeons we should be guided by Pancoast and Pendergrass in exercising the greatest caution in making a diagnosis of first stage silicosis from an x-ray film. Incidentally there is so much uncertainty concerning the diagnosis of first stage silicosis that the English have called this the ante-primary stage. The more easily diagnosed second stage, American classification, they have called primary silicosis and the fully developed fibrosis of the third stage corresponds to their secondary stage.

The ante-primary or first stage has no medico-legal significance and I do not believe there are any symptoms that can be definitely recognized. The disease may proceed rapidly or slowly from one stage to the next depending on factors previously mentioned. There was in our series no essential change in the x-ray findings of the men exposed one year and those exposed seven years. And it is also very significant that these 89 films were taken in a plant-wide x-ray examination for tuberculosis so that we had an excellent opportunity to compare the x-rays of men not exposed to silica dust with those so exposed. Silicosis was indeed found in a few of these 3000 men, but it was not of the origin we are discussing.

THE estimation of functional disability in pulmonary fibrosis has been admirably dealt with by McCann and his associates.[4] McNally, in discussing this paper read at the A.M.A. convention in Cleveland in 1934, remarked on the use of the respiratory index to determine lessened function in fibrotic lung lesions. The formula mentioned by him was vital capacity divided by height of the body in centimeters as giving the respiratory index, which is 20 in normal individuals. And so while we could discover no clinical or roentgenological evidence of silicosis it was considered worth while to determine if there was in the men exposed any altered pulmonary function by this method. The average of 18 men engaged for seven years in wheel polishing showed height 69.8 inches (175 cm.); vital capacity 4083; respiratory index 23.4. The average age of these men was 35.8; average weight 165.5 lbs.; average chest expansion 3½ inches. Only two of the 18 fell below the 20 average respiratory index. The excellent averages indicate the general health of the men. These results run parallel to the x-ray findings.

Why does not amorphous silica produce silicosis? Several ideas have been put forward to explain this: (a) The protective action of other dust, in our case, the other ingredients of the polish. Haldane and Mavrogordato[5] showed that the addition of relatively inert dusts to silica stimulates the bronchial mucous membrane and its ciliated epithelium to expel the dust before it becomes fixed in the pulmonary tissue. The relatively small amount of other dusts in the polish would hardly support this idea. (b) The mechanical theory that because of the oil and grease found in the mixture there is an agglom-

eration of particles and that these are too large to cause damage, yet the size of the dust found would contradict this theory. (c) The terms I have used in describing the physical characteristics of tripoli — "rounded edges," lack of "crystal" formation, "amorphous" — all indicate that I am still exploring the theory that the injurious effects from silicious dusts are due to the irritating mechanical effects of the sharp edges of the particles inhaled on the pulmonary tissues. This theory was held for many years, but within recent years it has been pushed aside by the theory that pathological changes in the lung are the result of chemical poisoning. Gye, Kettle and Purdy[6] showed that silica in colloidal form is a cell poison.

Bacteria ordinarily present in the soil possess the power of converting mineral silicates into soluble silica. When soluble silica or silica dust is injected into the tissues of animals fibrosis occurs. These investigators proposed the hypothesis that the alkaline fluids of the body slowly dissolve particulate silica and thus minute quantities of colloidal silica are liberated, and this constitutes the irritant responsible for the proliferation of the connective tissue. Miller and Sayers,[7] and later McCord,[8] working on the chemical theory as the cause of silicosis injected a number of guinea pigs intra-peritoneally with a variety of emulsions containing dusts of crystalline and amorphous silica, iron oxide, carborundum, aluminum oxide, limestone, gypsum and magnesium carbonate. Some of these substances led to the inert reaction characteristics of foreign bodies, others disappeared through absorption but the silica injections (both crystalline and amorphous) led to the formation of typical silicotic nodules within 30 days. No difference could be found in the nodules produced by quartz silica and the amorphous form. Nodules were found not only on the anterior abdominal wall but irregularly on the liver, diaphragm, mesentery, omentum and sexual organs as well. If this effect is produced in the abdomen the same effect should be produced in the lymphatics of the chest by inhalation of dust with a high silica content. This premise holds true for the crystalline silica but not for the form as found in tripoli.

"No adequate explanation of this can be proffered," to quote McCord, "but some significance may be attached to the observation that the electrostatic charge of tripoli particles is such that particles tossed into the air tend to agglomerate into small loose clumps or masses and drop to the ground. The electrostatic properties of tripoli particles may serve a highly useful purpose in the avoidance of silicosis in tripoli workers." It would seem probable that the friction to which the tripoli paste is subjected would increase the electrostatic charge of the particles involved and aid in this protective action.

We would like to know the *why*, but as industrial physicians the *why* is not so important as the *what*.

THE CONCLUSION reached at this stage of our experiences in Pontiac is that the dust from tripoli paste has not in x-ray examinations altered the lung markings from the normal nor has it lowered the vital capacity, respiratory quotient or general health of the men engaged in the work.

RECOMMENDATION: Despite the above conclusion I would heartily recommend the careful pre-employment examination of all men engaged in this work. This should include a history of all former occupations; and x-ray study of the chest; rejection of any applicant having history of asthma, bronchitis or cardiac trouble or a lung badly scarred from former tuberculous activity; a repeat examination every year; change of job for anyone objecting to the work, and control of dust as far as possible.

References:

1. *J.A.M.A.*, 106:11, 913.
2. Letter to Mr. Case from Sno-Flake Products Co., August 10, 1937.
3. The Roentgen Classification of Pneumonoconiosis, PANCOAST-PENDERGRASS, *J. Indust. Hyg.*, 16:6, 328.
4. Disability in Pulmonary Fibrosis, MCCANN et al, *J.A.M.A.*, 103:11, 810.
5. Industrial Health, KOBER and HAYHURST, p. 1075; also HUFFERMANN, *J. Indust. Hyg.*, November, 1926.
6. *Lancet*, October 21, 1922, p. 855.
7. *J.A.M.A.*, 103:907, September 22, 1934.
8. *J.A.M.A.*, 106:913.

Preventive Measures in the Use of Crystalline Silica

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BEFORE any preventive measures are instituted in the use of crystalline silica, it is essential to establish the fact that a silica hazard exists.

This can be established on the following data:

1. That there is a definite exposure to dust, which is known to contain a certain percentage of silica.

2. That the dust exposure, as estimated by the dust count and composition, is sufficient to cause silicosis if the exposure is continued over a sufficiently long period of time.

The control of a silica hazard, once it is established that such a hazard exists, is best considered under three aspects:

(A) Medical.
(B) Engineering.
(C) Managerial.

Medical Aspects

DURING the past few years many of the states have included silicosis in their occupational disease laws and have provided payment of compensation to employees disabled from the effects of this disease.

Let me point out, at this time, that while dust control alone can prevent the occurrence of silicosis, medical methods may postpone its appearance and modify its severity in an individual when it occurs.

Functions of medical control should include the following:

1. To demonstrate the occurrence of silicosis in specific industrial processes and to determine its importance in each.
2. To provide for the selection of working staffs so that unsuitable applicants (particularly those in whom tuberculosis is present) are not placed in dusty exposures.
3. To detect those in dusty exposure who have already developed pulmonary tuberculosis, so that they may be removed from silica and contact with their fellow-workmen.
4. To detect the first development of silicosis in an individual exposed to silica dust, and arrange his rotation or transfer to a less dangerous occupation, or for his removal from work where this is considered necessary.
5. To supervise, and frequently examine, silicotics remaining at their regular work which has a silica exposure.
6. By complete periodic medical surveys to check the effectiveness of the engineering methods of silicosis-prevention being used.

Thorough pre-employment examinations, including a roentgenogram of the chest, are essential in any medical control program of the silicotic problem.

Through these thorough physical examinations, the *physically unfit* will be eliminated from hazardous employment, and anyone giving a history of having been subject to sinus conditions, frequent bronchitis, repeated attacks of pneumonia, or influenza, tuberculosis, asthma, or other respiratory diseases, should not be employed on work carrying with it a hazard of silicosis.

Even though the employee gives a negative history and the physical examination reveals no evidence of an active pathological condition, many rejections for employment in a silicosis hazard will be made upon the roentgenographic findings, alone.

Many employees are truthful in giving a negative history regarding certain respiratory diseases, particularly diseases of childhood and early adult life, of which their memory is very vague. However, evidence of these diseases may be revealed on a roentgenogram of the chest.

We feel that the following x-ray findings should be sufficient for rejection for employment in work with a silicosis hazard.

1. Large hilus shadows with many calcified glands, many quite irregular in outline.
2. Primary complex—often described as "Ghon's tubercle."
3. Marked increase in the trunk shadows, extending towards the bases. (Usually this finding is secondary to a chronic catarrhal condition.)
4. Evidence of healed adult tuberculosis or evidence of active tuberculosis.
5. Increased trunk markings, or fan-shaped arrangements extending into either upper lobe.
6. Many small scattered calcified areas throughout both lungs.
7. Emphysema of the lungs.
8. X-ray evidence of any other pathological condition, such as mycotic infections, unresolved pneumonia, thickened inter-lobar pleura, etc.

In other words, before an employee should be passed for employment to work in a silicosis hazard he should show an average normal chest x-ray.

The average wide-awake employment manager will not pick out unhealthy appearing workmen to send back for physical examination on hazardous jobs, and, therefore, I feel certain that most of our rejections (30 to 60%) will be based upon x-ray findings, rather than physical findings.

From many years of experience, I believe that pre-employment history, covering the ailments and diseases which the employee might have suffered, is of very little value in determining whether or not the man is fit for employment in the silicosis hazard, for, as you all know, when a job is at stake, past ailments are greatly minimized. Medical history, here, takes on an entirely different aspect from when a patient is seeking relief from an ailment.

PERIODIC EXAMINATION: Periodic medical surveys of the entire group exposed to the dust are essential and, again, the x-ray plays a most important part.

We have seen cases demonstrating first and second degree silicosis, in whom, upon physical examination, regardless of care, there is no evidence demonstrable of disease in the lungs. We have seen individuals with rather advanced second degree nodulation who still have a three-inch chest expansion with no rales and very little or no changes in the breath sounds, except a generalized muffling. The percussion notes in conditions of this sort are, perhaps, generally diminished, but the notes are uniform over both lungs unless definite emphysema exists at the base.

Periodic medical surveys give the best check that we know of as to whether or not the engineering control methods are adequate and effective.

The medical control of any silicosis problem is closely tied up with the estimation of physical disability as a result of silicosis, and is closely related to the compensation problem. Some state that simple silicosis is very seldom a disabling disease, and that it is only when silicosis is complicated by infection (usually tuberculosis) that it becomes a disabling disease and a compensation problem.

Engineering Aspects

FIRST, it is essential to determine that there is a silicosis hazard. It is true that many jobs may be extremely dusty and yet carry little or no serious health hazard. However, in modern industry it has become the general practice that

wherever an unusual amount of dust is generated control measures are instituted,—even though the dust is not especially harmful.

Such dust control measures add to the cleanliness of the plant and have the advantage of reducing the possibility of claims for illness caused by dust inhalation.

Once you have established that the dust with which you are dealing has a definite amount of free silica present and that the quantitative exposure is sufficient to produce silicosis, then you know that sooner or later you are to be faced with the silicosis problem unless *proper* and *adequate* engineering control measures are established.

It is entirely the problem of the engineer to prevent silicosis. The medical division can only check and see whether his methods of control are adequate.

A reasonable objective of five million particles of free silica dust per cubic foot has been set as a safe atmosphere in which a man may continue to work over a long period of time, without likelihood of contracting demonstrable silicosis. There may be some question however as to whether or not this figure will always hold as being absolutely safe for individuals who are susceptible to the irritating properties of silica dust.

Assuming that the above figure is correct, then if a dust contain 30% to 35% free silica a safe atmosphere in which a man could continue to work over a long period of time, would be approximately 15 million particles per cubic foot of air.

I feel, personally, that workmen need not be required to breathe even five million particles of silica dust over long periods of time. Control measures that we now know of, which can be installed without an unusually great outlay, can furnish pure air with less dust than the average street air we ordinarily breathe.

The various parts of the engineering control apparatus may be mentioned as follows:

1. The exhaust system.
2. The positive pressure air hoods, which should be furnished to individual operators.

The exhaust system for dust control consists of several parts, as follows:

(a) Exhaust hoods.
(b) Piping.
(c) Cyclones, or other primary separators.
(d) Secondary separators, such as cloth filters or electro-static precipitators.
(e) Exhaust fans.

Exhaust and piping are rapidly becoming standardized in engineering design and little is left for engineering variance.

It is quite practical, now, to obtain a velocity of 200 linear feet per minute in many of the exhaust hoods. Of course, the velocity of the air varies according to the distance from the opening in the exhaust hood at which the velocity is measured. At once entrance of the exhaust pipe, the velocity may be as high as 1500 feet per minute, but at the face of the hood it should be maintained, in most instances, at 200 feet per minute.

In certain dusty occupations, where it is necessary to recirculate the air, the ordinary primary cyclone-type dust separator is all that is necessary. However, in cases where the air is to be recirculated, then secondary separators such as cloth filters, following the primary ones, are usually installed, and samples of air taken after the air has passed through the cloth filters should have a count of around one million particles or less per cubic foot.

In order to prevent clogging of cloth filters with dust it is essential that they be cleaned regularly. The air supplied to the positive pressure air hood should be clean, free of carbon monoxide, carbon dioxide and oil fumes, and have a dust count of not over one million particles per cubic foot. It is also well in the summer months to cool this air, although this is not an absolute necessity.

Other methods of dust control have been instituted according to the problems involved — for instance, the control of dust by the wet-blanket method after blasting in mines; also, the wet-drilling method used in mining and in rock drilling for construction work; the application of exhaust hoods at the point of origin of the dust, as in granite cutting, rock drilling; and other engineering methods adopted only for the particular dust at the point of its origin depending upon the type of industry involved.

However, the whole engineering problem simmers down to two main points in the control of any dust hazard:

1. The elimination of the dust by an adequate exhaust system.
2. Furnishing to the man engaged on the hazardous occupation pure uncontaminated air by means of a positive pressure air hood, when necessary.

These two methods, applied to any dust problem, can prevent the possibility of a disease due to dust.

Respirators may be the solution of minor dusty problems, but positive pressure air hoods are far superior and should replace them when dealing with dust control in which silicosis is the real hazard.

Managerial Aspects

LAST, but not least, before anything can be accomplished in the matter of dust control, it is essential that management be informed on this problem and give its whole-hearted cooperation to the efforts of the engineer and the doctor in the establishment of the preventive measures which, according to their combined judgment, are essential to the particular hazard involved.

Once the preventive measures are established and put into operation they are not sufficient to control the silica hazard unless supervision is constantly maintained and not at any time allowed to become lax. We can all agree that it is quite a useless outlay of money to put in an expensive exhaust system, furnish the men with positive pressure air hoods and then find the exhaust fan out of commission or the hoods hanging on a

hook and the men working without the protective measures furnished them.

In 1978, silicosis will probably be relegated to the list of diseases of the past, and no industry, mining or otherwise, will ever think of operating without first controlling its dust hazard. Students of medicine will wonder why it took man from the time of Hippocrates up to the 20th century to accumulate sufficient engineering skill to control dust hazards and thereby eliminate our oldest occupational disease.

References:

Silicosis Symposium, Saranac Lake, N. Y., 1937, DR. RIDDELL's paper.

Engineering Control of Dust Problems, by PROFESSOR PHIL DRINKER.

Silicosis and other Dust Diseases, by ALBERT E. RUSSELL, M.D., United States Public Health Service.

A Cooperative Effort in the Control of Tuberculosis

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DURING the past 10 or 12 years, the practice of industrial medicine has undergone three distinct changes. In the early part of this period, industrial accidents and minor illness occupied the major portion of the industrial physician's attention, but as safety practices reduced the number of accidents, a new problem presented itself, viz., industrial diseases. At first there was opposition on the part of many to the enactment of industrial disease legislation, but when it came and sufficient time elapsed to determine the nature of the problem it was found that occupational diseases as constituted by law did not present serious difficulties so far as control was concerned and that the loss of time incident to the so-called legal occupational diseases was remarkably small. Consequently the efforts of industrial medicine have drifted into a third phase, viz., that of the study of the general industrial health. We have found it necessary to be able to answer this question: To what extent does industry contribute to the morbidity and mortality of diseases not ordinarily considered occupational? The answer to this question need not be that industrial processes themselves are responsible. It is quite evident that certain other factors, largely personal, are indeed important elements in determining the nature and extent of disease among those employed.

About 18 months ago, I assumed the position of plant physician for a grey iron foundry employing up to 6000 persons. The safety statistics were readily available, but considerable uncertainty existed as to the amount of occupational and industrial disease. It did not require a long period to determine that occupational disease as legally constituted was a relatively minor problem. Silicosis was found to be unusual, and the cases that were found presented occupational histories prior to foundry employment that could explain the disease. For a while I thought we had a manganese problem, but with discovery of the causative factors and simple corrective measures, it vanished. Skin diseases were found to be infrequent and readily controlled.

Meantime, however, we were keeping statistics covering loss of time of one day or more for every reason, and it was quite apparent that if a good job was to be done, we should attempt to explain the relationship, if any, of such diseases as common colds, pneumonia, bronchitis, arthritis, heart disease and tuberculosis. Since it was not possible to go into all these problems at one time we decided to begin our attack on tuberculosis.

I felt that as industrial physicians we should fall in line with the campaign being waged against tuberculosis throughout the nation. As industrial physicians we should inform ourselves of the tuberculosis hazard and rate in our plants, city or town, and county and state: its relationship to occupation, racial characteristics, housing, climate, income and other factors. (See Table I.)

TABLE I

RELATION OF TUBERCULOSIS TO VARIOUS FACTORS

MICHIGAN STATISTICS:			
DEATH RATE IN INDUSTRIAL COUNTIES:			
Gogebic (Mining)	88.6	per	100,000
Ontonagon (Mining)	89.9	"	"
Houghton (Mining)	96.5	"	"
Wayne	56.2	"	"
Saginaw (Foundries)	47.1	"	"
DEATH RATE IN NON-INDUSTRIAL COUNTIES:			
Sanilac	13.6	"	"
Clinton	11.5	"	"
Ionia	22.8	"	"
TYPE OF RACE:			
Tuberculosis is three times more prevalent in negroes than in whites and higher in certain other races, e.g., Mexicans.			
LIVING CONDITIONS:			
Rental $10.00 to $20.00	Death rate 125	per	100,000
Rental $30.00 to $45.00	Death rate 50	per	100,000
Rental $55.00	Death rate 25	per	100,000
OCCUPATIONAL AGES 25 TO 44:			
Professional men	30	per	100,000
Clerks	70	per	100,000
Agricultural workers	45	per	100,000
Skilled workers	70	per	100,000
Unskilled workers	100	per	100,000
Foundry, under study	56.4	per	100,000

This approach to such a problem as tuberculosis characterizes us as industrial health officers. I feel that we cannot escape the fact that the more

we are health officers for the industry we serve, the more will be our value to the industry and the community. Of course this becomes more important in those states where tuberculosis may be construed to be an occupational disease.

In undertaking a study of this question it was quite evident that the cooperation of many persons and agencies would be necessary—the plant management which was willing to let the plant physician assume the responsibility for the results, the local and county Health Department to which reports would have to be sent, the City Tuberculosis Society and County tuberculosis nurses to whom the Health Departments delegated the job of investigation, appointment for x-rays, and follow up, the local hospital council who were willing to agree that tuberculosis was a community problem first and that industry should not be made to bear all the expense of its control, and with whom an informal agreement was concluded as to the amount of financial assistance the industry should give the Tuberculosis Society for its investigation and x-ray work, the local physicians, the local roentgenologist, the plant nursing and clerical staff, and insurance and employment departments. The cooperation of all these was found to be essential.

TABLE II

TUBERCULIN RESULTS 1937 - 38

Number of physical examinations			4790
Total tests given			550
Total number of employees			458
Did not report at all or are awaiting test			55
Total taking first test			333
Negative	240	72%	
Positive	93	28%	
Total x-rayed without tuberculin test			63
Total not taking second test after first negative (Reason: lay-off, x-rayed, etc.)			33
Total taking second test			207
Positive	170	82.1%	
Negative	37	17.9%	
Total completing the test			300
Positive	263	88%	
Negative	37	12%	
Of 363 x-rayed included as positives			
Positive	326	90%	
Negative	37	10%	

New forms, necessary to provide information were adopted. On the front of the examination card a form was provided for recording all loss of time of one day or more. On the examination record side the results of the examination were briefly stated and tuberculin and x-ray results if any recorded. A card was also provided for recording past occupations and on the rear thereof the past history of the employee. Complete examination of all employees was begun. Up to the time of summarizing the results of our study for this paper 4790 employees had been examined, including applicants. Those showing records of loss of time for colds, bronchitis, pleurisy, pneumonia and other associated diseases, those showing symptoms or signs suggesting tuberculosis or giving history of tuberculosis in the family or other contacts, and those giving history of occupation wherein tuberculosis is believed to be prevalent, were requested to come in for tuberculin studies. (See Table II.)

Four hundred and fifty-eight individuals were studied; and 550 tuberculin tests were made using .0002 mgm. of purified protein derivative in 0.1 cc. of solution for the first test and 0.005 mgm. for the second test where necessary. The solutions were made up each Monday and used within not more than two hours. The flexor surface of the forearm was used for the intracutaneous test. The tests were read after 48 hours and were recorded according to recommendations appearing in the American Review of Tuberculosis in 1934. Sixty-three employees were x-rayed without being tuberculin tested because they were evident cases of tuberculosis, or because of necessity for speed incident to transfer, or for other reasons. At the time of this summary 55 were awaiting their first test or had been lost track of because of lay-off. Three hundred and thirty-three were given the first test, 93, or 28%, being positive and 240, or 72%, being negative and therefore requiring a second test. Thirty-three of these 240 are awaiting their second test, have been lost track of by lay-off or, in a few instances, have declined the second test. Two hundred and seven have been given the second test. Of these 170, or 77%, were positive and 37, or 23%, negative. Therefore of the 300 completing the test only 37, or 12%, were negative and 263, or 88%, were positive. I feel that the 63 who were x-rayed without being tested would have been found to be nearly 100% positive.. If we assume, and fairly so, that all this latter group were positive our results would be 90% positive and 10% negative. On first thought it would seem to be a logical conclusion that tuberculin tests were contra-indicated in view of the large percentage of positives, but in this connection several things must be considered. In the first place if the general tuberculosis campaign is to be successful, and it will, it will result in decrease of the tuberculin positives and an increase of negatives and the success of the campaign will be in relation to this shift. In other words tuberculin tests in adults will be necessary to gauge the progress of the campaign. In the second place, there is a tendency for us to disregard the tuberculin negative group as being non-infected, but we must not forget that this negative group is our most susceptible group so far as danger of contagion is concerned and some plan should be improvised to watch this negative reaction group. The only logical conclusion is that either universal roentgen rays or universal tuberculin testing will continue to be necessary, and the sooner this is recognized the sooner will tuberculosis be controlled.

At completion of the tuberculin tests a report was made to the patient's family physician only if the test was negative and to both the doctor and the Board of Health if positive. This report included in addition to name, age, address, the details of the employee's occupation and of the tuberculin tests. These reports were turned over

to the Tuberculosis Society if a city resident or to the County Tuberculosis nurse if a county resident. The nurses called on the family of the positive reactors, arranged for x-ray examination and advised that the remainder of the family report to their family physician for tuberculin tests and x-ray study. In some cases where the family could not afford to see their family physician for this work, the city physician was asked to do it.

In the first few months of the study the positive reactors were investigated and x-rayed using the Tuberculosis Society funds without cost to the industry, but as the cases increased in number and the financial burden became too great the arrangement mentioned above, negotiated through the hospital council whereby the plant absorbed a part of the expense incident to each case, was adopted. I feel that it is just as important to study the family of a tuberculin positive patient if he has a negative x-ray as if that x-ray showed tuberculous infection. In one case (J.Q.), who was tested because his wife died of tuberculosis, the tuberculin test was positive but the x-ray was negative. However a routine study of his six children who were in an orphanage showed three cases of active adult type tuberculosis.

TABLE III.
SUMMARY OF X-RAY FINDINGS

Negative Chest	136	(62.1%)	
Active TB.	12*	(5.6%)	5 died; 7 hospital
Suspicious—Requiring further study	6	(2.7%)	
Upper respiratory infection	11	(5.0%)	
Healed TB.	35	(16.0%)	
Pleurisy with effusion	1	(.46%)	
Pleural thickening	1	(.46%)R	
Tumors	2	(.9%)	mediastinal 1; sarcoma, lung 1
Severe Hilus thickening	2	(.9%)	
Cardiac irregularities	7**	(3.2%)	
Silicosis suspected	6***	(2.7%)	
	219		

*1 moulder 11 years; 1 core assembly 6 years; 1 foundry laborer 8 years; 1 iron pourer, moulder 8 years; 1 foundry 4 years, shakeout.

**Enlarged aorta 4; possible mitral disease 1; increased cardiac size 2.

***2nd stage 1; 1st stage 1; suspicious 1st 4.

This report concerns those x-rayed in Saginaw City and County only. (See Table III.) Some were x-rayed in Bay City and County and by their own physicians, but these groups are not included in this study. Two hundred and nineteen such cases were x-rayed in Saginaw City and County; 136, or 62.1%, showed negative chests; 12, or 5.6%, (2.5 per thousand examinations) showed active tuberculosis. Considering the fact that this represented all the suspected cases in 4790 people, it is not large but is well worth working for. Of these 12, five have died of tuberculosis and seven are in the hospitals at the present time. In addition six, or 2.7%, were found to have suspiciously active chests requiring further study. The Tuberculosis Society and County tuberculosis nurses are doing an excellent job of watching this type of case. Eleven, or 5%, were found to have nonspecific upper respiratory infection. Thirty-five, or 16%, were found to have healed tuberculosis. This group is interesting in that the great majority, if not all, showed healed tuberculosis of the childhood type and in almost every instance history of contact with other members of the family, room mates, etc., could be obtained. This was also true of the active and "suspicious" group. I have found no evidence to prove that a foundry occupation is a causative factor in tuberculosis. I bring out this point because it is essential to the success of the tuberculosis campaign. If it is assumed that workers have a high tuberculosis rate solely because they are in industry then the control of the disease might be left solely to industry itself which I feel will doom the success of the general tuberculosis campaign. Thirty-one of this healed group were checked with reference to the predominant type and length of occupation. It was found that 12 worked in the foundry proper, 12 in the core room, five in the cleaning room and one each in pattern shop and power house. As this is about the same proportion as the employment in these departments, it is a good indication that the type of occupation was not a cause of the tuberculosis. Furthermore the average length of employment in the plant was 8.4 years and since these employees had a childhood type of healed tuberculosis, it speaks very well for the occupation that after 8.4 years they are still healed and non-silicotic. The average length of foundry department proper employment was 7.4 years, core room 7.3 years and cleaning room 8.6 years.

In addition to the above there was one case of pleural effusion (.46%); one case diagnosed as severe pleural thickening (.46%); two tumors of the lung (.9%), one a sarcoma of the chest and one a mediastinal tumor; two cases of hilar thickening severe in type (.9%); and seven (or 3.2%) cardiac irregularities (four enlarged aorta, one possible mitral disease, and two showing increased cardiac size).

An important consideration in x-raying employees in cooperation with local physicians and agencies is the possibility that cases of suspected silicosis might be given an importance out of proportion to the extent of the disease and thereby stir up an anxiety neurosis, litigation, or both. This was thoroughly considered at the outset of this study and we decided to gamble on the fairness and good judgment of the private physician in handling this matter. The results have justified our position. There were six suspicious cases. One case was a definite second stage silicosis. This employee had been a miner for 10 years prior to being employed. One fairly definite first stage case had been employed by two foundries for a number of years prior to hiring out with us as a moulder in 1926. Of the four remaining cases all of whom had doubtful early silicotic markings, one was a blacksmith prior to doing foundry work, one had no history of dust exposure either before or after coming with us, one had been a moulder for us for nine years, and

the fourth case, while he had worked in a somewhat gassy atmosphere, had not been on a job which we felt would produce silicotic changes. All of these reports have been received by the employees' own physicians and there have not been any unfortunate results.

Wherever indicated, employees having suspicious or healed tuberculosis or suspicious silicotic changes have been transferred to as safe an environment as we could give them.

CONCLUSIONS: 1. The recent advance of the industrial physician into the field of industrial health requires for its success cooperation with a large number of individuals and agencies.

2. The handling of the tuberculosis problem is an ideal example of the necessity and value of this cooperation.

3. In my opinion, tuberculin testing in the future will probably be more universal than Schick testing today. At the present time the universal x-ray study of tuberculin testing (or both) of those in industry where the heads of families are employed offers one of the best attacks on the problem. Local agencies should recognize the fact that money spent today in support of this work will pay big dividends in the future.

4. All positive reactors to tuberculin and all cases of active, suspiciously active, and healed cases of tuberculosis should be reported to the local or county Health Departments and the responsibility for their follow up delegated to them.

5. Some plan of protecting the tuberculin negative group should be adopted and repeated tests of this group seem indicated.

6. The private physician is probably the most important element in the attack on tuberculosis, and while the industrial physicians must protect the workmen by uncovering active, suspiciously active, healed cases of tuberculosis therein, the families of all positive reactors should be referred to the family physician for further study.

A Plan for Health Maintenance

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Delco Products Division,
Moraine Products Division,
Dayton, Ohio

A SURVEY was undertaken to determine what, if anything, could be done to lower the number of days lost on account of sickness.

We felt that our accident record was improving constantly, but could see no corresponding improvement in the sick rate.

As a basis of comparison we decided to chart the insurance cases against the compensation cases for the past 10 years.

The results were so interesting that we went further, and broke down the insurance records into causes of lost time and death. This is only a small part of our lost time from illness. By far the greater majority of time is lost by illness lasting less than one week, which does not show in this study.

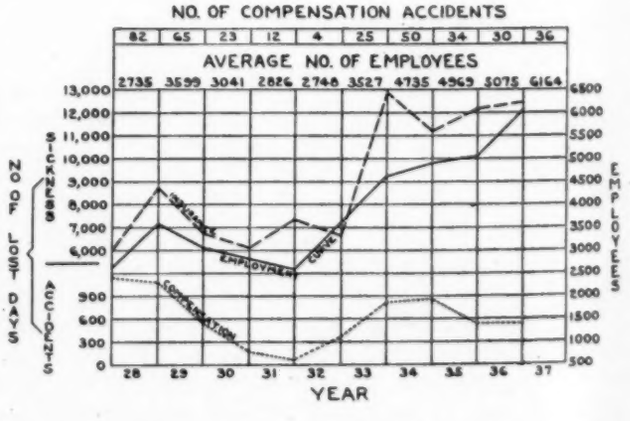
The employees in this plant are a carefully selected group. They are hired usually in small groups, with considerable care, and are then given a careful medical examination. After illness, lay off, and sometimes a transfer, these men are reexamined. There is no routine x-ray or laboratory study. Personnel and working conditions are well above the average.

The accompanying charts will give a quick idea of the comparative study.

It will be seen that the sick rate follows the employment curve closely. The accident rate has been forced down, particularly in the past three years.

A glance at the table of death claims shows that cardiovascular, respiratory diseases, accidents, neoplasms, gastro-intestinal and kidney disease account for nearly all the mortality, and in the order named.

It is also interesting to note that only two deaths during the first year of employment were attributed to chronic diseases. This speaks well for the efficiency of entrance examinations. Also note that in the group employed more than 10 years, cardiovascular diseases accounted for two-thirds of the deaths.



Examination of the tables of insurance claims again demonstrates the importance of the common cold, including complications: otitis, mastoid, sinusitis, bronchitis, pneumonia and pleurisy. Accidents run a strong second, followed by gastro-intestinal, then genito-urinary diseases. Mumps leads the infectious diseases.

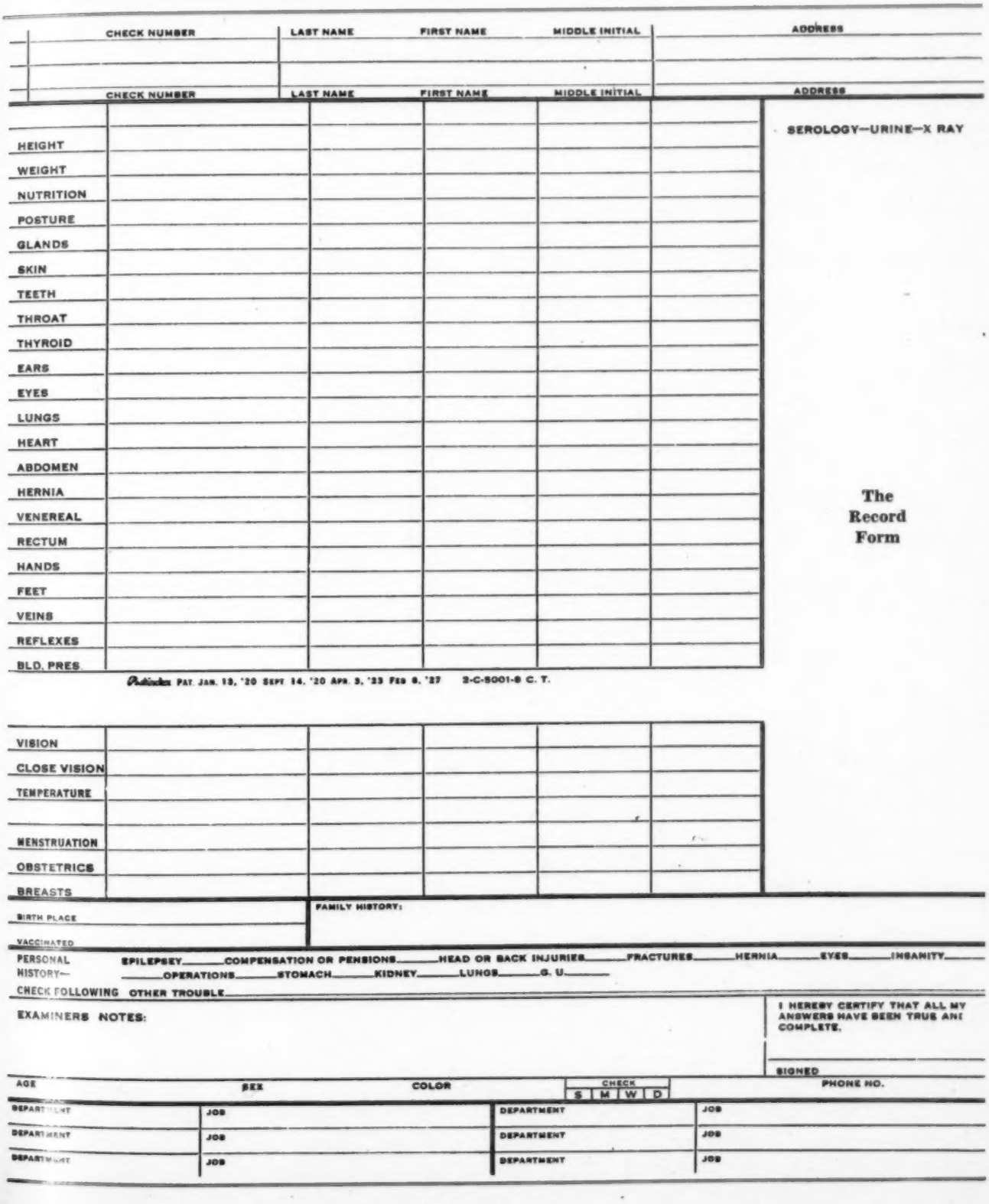
This record shows many obvious chances for

improvement. To mention a few preventable items:

140 cases of tonsillitis.
38 cases of tuberculosis.
16 cases of small pox.
14 cases of gonorrhea.
6 cases of syphilis.
97 cases of miscellaneous nervous disorders.
11 cases of insanity (mostly four plus).
141 cases of fractured bones.
230 cases of miscellaneous accidents.

To what extent are colds and stomach disorders related to focal infections and working conditions? The majority of our stomach disorders occur in the night shifts. We believe that much can be accomplished by a planned attack.

Our first move has been to install a new record system. This gives us the information which we have found of most value in our 20 years of experience at this plant, and still is kept in as simple a form as possible. Records of physical condition are kept folded inside. On the outer side is the case record. The cards are filed in a visible file by number and department. We use a flash system of color marking to call attention to special information.


CHECK NUMBER | LAST NAME | FIRST NAME | MIDDLE INITIAL | ADDRESS

CHECK NUMBER | LAST NAME | FIRST NAME | MIDDLE INITIAL | ADDRESS

SEROLOGY—URINE—X RAY

HEIGHT
WEIGHT
NUTRITION
POSTURE
GLANDS
SKIN
TEETH
THROAT
THYROID
EARS
EYES
LUNGS
HEART
ABDOMEN
HERNIA
VENEREAL
RECTUM
HANDS
FEET
VEINS
REFLEXES
BLD. PRES

Pat. Jan. 13, '20 Sept. 14, '20 Apr. 5, '23 Feb 8, '27 2-C-5001-8 C. T.

VISION
CLOSE VISION
TEMPERATURE
MENSTRUATION
OBSTETRICS
BREASTS

BIRTH PLACE
VACCINATED

FAMILY HISTORY:

PERSONAL HISTORY— EPILEPSEY____COMPENSATION OR PENSIONS____HEAD OR BACK INJURIES____FRACTURES____HERNIA____EYES____INSANITY____
____OPERATIONS____STOMACH____KIDNEY____LUNGS____G. U.____

CHECK FOLLOWING OTHER TROUBLE____

EXAMINERS NOTES:

I HEREBY CERTIFY THAT ALL MY ANSWERS HAVE BEEN TRUE AND COMPLETE.

SIGNED

AGE | SEX | COLOR | CHECK S M W D | PHONE NO.

DEPARTMENT | JOB | DEPARTMENT | JOB
DEPARTMENT | JOB | DEPARTMENT | JOB
DEPARTMENT | JOB | DEPARTMENT | JOB

EMPLOYEES

The Record Form

Conditions requiring special observation are flashed with a red mark. All transfer records are routed through the medical department, making it a simple matter to keep in touch with this problem.

Minor troubles which should be corrected are flashed with green. We have an average of one visit per employee per month to our medical department. This allows us 12 chances each year to give employees friendly advice about putting themselves in good condition.

We use the visible file not only because it is a time saver in recording, but also because it is so easy to look at each man's record at the time of his visit, that this important step in health control is not slighted by the medical personnel.

Our next move, the re-examination of all employees, was completed this past year by Drs. James and Loeb of the staff. We found that one man can examine about 1000 per month.

The information obtained is both valuable and surprising. Of 5675 employees (4508 men; 1167 women) only 177 refused examination. This group of 177 were all from the office or tool room.

By age groups 4402 were under 40; 977 were 40 to 60; 101 were over 60.

In the past 10 years our employment figures have never dropped much below 3000, so the figure of only 1000 over 40 years of age is difficult to explain.

Only 69 showed marked underweight, and only 185 were markedly overweight. We found:

353 skin conditions.
1789 oral infections.
19 cases of tuberculosis.
261 cardiovascular cases.
276 hernias.
6 venereal disease cases.
717 with defective vision, and of these 416 were uncorrected.
299 had some permanent disability.
424 are classed as risks.

Any condition which handicapped a man or would make some job hazardous was classed as a risk.

The largest number of these risks were hernia, high blood pressure, hearts, eyes, severe focal infections, syphilis, thyroids and tuberculosis.

Where necessary the jobs were adjusted to fit this group, and, as explained before, all their records are flashed with red for special care. They will constitute an increasing problem in operating under the seniority rules.

This tabulation also points out the limitations of such an examination. There are probably 150

EXAMINATIONS—SEPTEMBER, 1936, to NOVEMBER, 1937

No. to be Exam.	Dept.	Male	Female	Under-weight	Over-weight	Skin	Oral Infection	Lung Trouble	Cardio Vascular	Hernia	Venereal Diseases	Defective Vision	Uncorrected	Permanent Disabilities	Industrial Risks	Age Below 40	Age 40-60	Age Over 60
	3	86	.....	4	5	7	33	2	7	4	.....	19	7	8	6	63	23	.....
.....	9	183	.....	4	.....	20	80	2	.....	6	2	18	16	7	8	174	9	.....
.....	17	25	4	.....	2	5	16	1	1	.....	1	4	2	4	2	22	7	.....
.....	20	88	142	.....	12	13	13	1	5	4	1	23	6	6	5	219	12	.....
.....	23	10	37	.....	7	2	7	.....	2	.....	.....	7	2	1	.....	36	11	.....
.....	25	237	.....	3	7	17	72	4	10	16	1	25	15	40	9	183	50	4
.....	27	199	.....	1	10	14	75	.....	4	10	2	14	11	15	12	147	50	2
.....	28	89	.....	1	2	6	35	2	3	4	3	4	3	12	4	71	19	.....
.....	29	41	22	.....	2	2	24	2	6	4	2	8	2	2	8	44	16	3
.....	31	100	9	.....	2	8	41	.....	.....	15	1	14	8	10	14	85	21	3
.....	32	38	130	1	11	10	83	1	5	4	.....	37	16	4	4	131	36	1
.....	35	190	.....	3	10	15	71	.....	8	11	3	15	11	12	15	158	26	6
.....	37	67	.....	5	7	6	32	.....	7	9	5	10	8	5	11	47	20	.....
.....	38	68	.....	5	4	3	35	.....	4	12	1	15	9	11	11	48	20	.....
.....	39	184	33	4	6	15	92	.....	4	19	4	33	27	11	24	187	28	2
.....	43	74	287	8	21	27	120	.....	14	9	2	64	22	17	19	339	18	5
.....	44	68	384	3	16	22	127	.....	12	2	1	42	7	10	3	436	15	1
.....	47	263	.....	6	14	23	83	.....	11	1	9	33	18	23	10	219	43	1
.....	59	310	.....	.....	7	25	113	.....	7	13	6	37	24	12	21	271	38	1
.....	63	401	.....	1	10	47	147	.....	10	12	14	36	20	13	16	364	37	.....
.....	72	112	.....	5	5	5	42	.....	9	3	1	18	13	3	12	89	18	5
.....	73	10	.....	.....	.....	.....	3	.....	.....	.....	.....	1	.....	1	1	7	3	.....
.....	74	203	.....	1	2	15	65	1	13	8	4	25	13	5	10	172	31	.....
.....	75	266	3	1	8	5	116	.....	17	20	12	61	57	22	41	144	108	17
.....	76	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.....	.....
.....	77	45	.....	1	.....	5	10	.....	.....	.....	.....	7	4	.....	.....	37	8	.....
.....	78	33	.....	.....	.....	1	10	.....	7	3	.....	2	2	2	6	21	9	3
.....	79	90	.....	3	1	7	36	.....	6	9	9	24	19	8	20	41	40	9
.....	80	11	.....	.....	1	1	5	.....	2	1	.....	1	1	1	1	7	4	.....
.....	81	107	.....	.....	1	1	37	.....	6	11	7	19	18	9	9	52	42	13
.....	82	17	.....	.....	.....	.....	4	1	.....	3	.....	3	2	2	4	12	4	1
.....	83	75	.....	.....	3	2	17	.....	9	3	5	6	4	2	9	60	15	.....
.....	85	16	.....	.....	1	.....	6	.....	2	2	.....	2	2	2	2	7	8	1
2	86	45	.....	1	1	7	17	.....	2	4	3	7	4	2	6	36	7	.....
3	87	64	.....	.....	.....	.....	12	.....	12	11	2	9	9	5	19	34	21	6
.....	88	5	.....	.....	.....	.....	2	.....	1	.....	.....	2	2	1	.....	.....	5	.....
136	89	271	.....	1	4	8	38	1	12	10	5	12	7	4	20	85	44	5
.....	98	12	.....	.....	.....	2	1	1	1	1	.....	.....	.....	.....	3	10	2	.....
20	Office	199	115	2	1	5	30	.....	17	19	1	31	1	.....	22	250	41	3
1	Factory St. T.	100	1	1	1	1	27	.....	17	9	2	20	17	3	22	48	43	9
15	Confidential	97	.....	.....	1	1	12	.....	8	4	.....	8	7	4	15	38	44	.....
.....	Detroit Pay Roll	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	5	1	.....
	Total	4508	1167	69	185	353	1789	19	261	276	109	717	416	299	424	4402	997	101

5675 employed. 177 not examined.

cases of active syphilis in this plant, at the lowest estimate. We found only a few. We hope that a sentiment will develop in favor of voluntary blood testing. There is little excuse for failure to give this problem serious consideration.

The 4400 employees under 40 years of age would surely show a much larger tuberculosis rate if an x-ray could be routine.

The first requisite in any health program is to have the confidence of both the employee and the

INSURANCE CASES

		Four Months 1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Total
Head	Concussions			1				2	3			6
	Fractures					2		1	1		1	5
Eyes	Injury	1								1		2
	Disease		3	1	2		1	3	2	2	6	20
Ears	Otitis media		1	1	1	1	2		3	2	9	20
	Mastoiditis		1	2	1	1	1		1			7
Nose Teeth									1	1	2	4
	Teeth extraction		1	3	3	3		3	8	5	4	30
Upper Respiratory Tract	Sinusitis	1	1		2	3		4	3	6	4	24
	Tonsillitis	4	18	6	8	7	9	15	19	28	26	140
	Pharyngitis			1			1	4	1	3	8	18
	Operations	1	6	5	4	1	1	3	18	10	20	69
Respiratory Tract	Asthma		3	1	1		1	1	3	3	3	16
	Bronchitis	4	11	7	1	3	4	5	17	23	17	92
	Pneumonia		4	5	7	3	2	5	10	11	11	58
	Pleurisy-pleurodynia		3	6	2	1	5	4	7	9	7	44
	T. B. C.		11	4	5	4	3	3	4	3		38
Cardio-Vascular	Heart		4	5	3	5	2	4	6	9	7	45
	High blood pressure		1					6		1		8
	Cerebral hemorrhage				2	1	1	2		1	1	8
	Varicose ulcers				2	1			1	2	1	7
G. I. Tract	Acute disease		10	5	4	5	7	18	8	10	11	78
	Chronic disease	4	25	12	7	10	7	16	13	23	29	146
	Hernias — operated		1	3	2	2	4	1	2	4	7	26
	Operations		5	7	7	8	3	7	14	12	25	88
G. U. Tract	Gonorrhea		1	1				3	2	4	3	14
	Syphilis		1	3			2					6
	Prostate		3	1	5	3	3	6	7	7	4	39
	Kidney disease		4	5	9	6	4	15	11	18	14	86
	Diseases of women		3	2	4	8	4	8	3	4	10	46
	Operations		1		3	1	4	4	1	2	2	18
Nervous System	Miscellaneous nervous disorders	2	9	4	3	2	3	7	15	24	38	97
	Sciatica		1	1	3	2	3	1	3	3	1	18
	Herpes zoster				1		1		1	1	1	5
	Insanity				1	2	1	3	2		2	11
Orthopedic	Bone and joint disease		9	6	7	7	6	9	10	10	11	75
	Fractures	2	13	10	14	5	8	20	14	24	26	136
	Low back pain	1	5		3	1		7	5	15	8	45
	Corrective operations			1			1					2
Obstetrical	Pregnancy			1	3	12	12	35	14	7	18	102
	Miscarriage			1		1	1	2	1	1	2	9
Infectious Diseases	Cold — influenza — grippe	6	56	25	30	24	16	49	68	51	79	394
	Scarlet fever		3		3		3	5	15	5		34
	Diptheria	2					2		2	1		7
	Measles			10			1	2		2	1	16
	Chicken pox	1	3		1				2		1	8
	Erysipilas		1	2		1		1	1			6
	Mumps		1	6		13		2	11	9	2	44
	Small pox		2	13		1						16
	Vincent's angina		1			1	2	1	4	4	2	15
	Malarial fever		1			1			2	1		5
	Whooping cough				1							1
	Typhoid						1	1			2	4
	Anterior poliomyelitis										1	1
	Undulant fever										1	1
	Tularemia					1						1
Endocrine Diseases	Thyroid		8	1	2	2	1		2	2	2	20
	Pancreas (diabetes)		1						1	1		3
	Adrenal (Addison's)		1									1
Diseases of blood forming organs	Anemias		1		1		2			2	1	7
	Leukemias			1			1					2
Malignancies	Carcinoma					1					3	4
	Sarcoma		1								1	2
	Epithelioma	1										1
	Hodgkin's disease								1	1		2
Skin Diseases	Furunculosis—sm. abscesses	1	9	5	2	1	2	12	6	6	7	51
	Dermatitis		1	3		2	1	4	4	2	3	20
	Eczema		1	1	1		2		2		2	9
Chemical Agents	Lead poisoning	1										1
Physical Agents	Heat exhaustion						1	1		6		8
Minor Injuries	Contusions — lacerations — infections — sprains	7	12	10	6	15	10	22	23	37	37	179
	Automobile injuries		6	1			2	4	10	1	4	28
	Gun-shot wounds	2	1	1		1		1	1	3		10
	Burns		1		2	1	2		1	1	5	13
	Total	41	270	191	159	176	156	331	390	425	483	2622

DEATHS—DELCO EMPLOYEES FROM JANUARY, 1931, THROUGH DECEMBER, 1937

		AGE PERIODS			LENGTH OF SERVICE										
		20–40	40–60	Over 60	Under 1 Year	1–10 Years	Over 10 Years	1931	1932	1933	1934	1935	1936	1937	Total
Head	Fractures	1			1								1		1
	Automobile accidents	5	1		1	5				2	1		2	1	6
Upper Respiratory Tract	Streptococcic throat			1		1						1			1
Respiratory Tract	Pneumonia	7	2	1	1	6	3		1	1	1	1	4	2	10
	T. B. C.	2	4	1		5	2		1	1	2		1	2	7
Cardio Vascular	Heart	10	16	6	1	13	18	5	4	3	2	6	8	4	32
	Cerebral hemorrhage	1	5	4		4	6	1		1	4	2		2	10
G. I. Tract	Acute disease	4	2		2	2	2				3	1	1	1	6
G.U. Throat	Kidney disease	1	4			2	3	2	2			1			5
Nervous System	Paralysis			1			1			1					1
Orthopedic	Bone and joint disease	1	1			1	1	1					1		2
	Fracture spine	1			1						1				1
Obstetrical	Miscarriage	2			1	1						1		1	2
Infectious Diseases	Eucephalitis	1			1									1	1
Endocrine Diseases	Adrenal (Addison's)	1				1		1							1
Diseases of blood forming organs	Leukemia			1			1							1	1
Malignancies	Carcinoma		3	3	1	4	1		1	2	1		1	1	6
	Sarcoma	1	1			2			1		1		1		2
	Hodgkin's disease		1			1							1		1
Chemical Agents	Carbon monoxide		1			1					1				1
Injuries	Automobile accidents	1	1		1	1			1				1		2
	Gun-shot wounds	1	1		1	1				1				1	2
	Fall	1				1			1						1
	Drowning	1		1		1	1			1	1				2
	Aeroplane	1			1									1	1
	Total	43	43	19	13	53	39	10	11	13	18	13	22	18	105

Diagnoses not available before 1931.

Number of Deaths	
1927	7
1928	6
1929	10
1930	14
	27

TOTAL DEATHS, 132

local medical fraternity. No effort should be spared to help an employee solve his health problems. The utmost patience must be exercised in your dealings with him. You must be fair and you must hold his statements in confidence. The properly selected, registered nurse, is one of your biggest assets. Never permit yourself to be used as the police department for any other factory official. Stick to facts and make your own medical decisions. Your honesty of purpose will be respected.

Cooperation with the family doctor or other established agency is the only logical way to make progress. If your employee is treating with a quack, don't hesitate to tell him. Treatment of conditions for which the plant is not responsible is wrong. The plant physician and family doctor can be of great mutual assistance, but the plant physician must take the initiative.

With the trust of the employee and the family physician, and assurance from the management of the confidential nature of your records, it is now possible, by frequent examination and consultation to start a campaign for better health.

I believe that any good usable record system, such as the one displayed, with the visual reminders, and with conscientious use, will effect a marked improvement in health experience. We will feel happy if we are able to remove these green flashes from the 1789 oral infections. Two

TOTAL DEFECTS OF RISKS

CAUSES	20–40	40–60	Over 60	Total
Eyes	22	78	21	121
Hearing defect		6	2	8
Deaf and dumb		2		2
Pyorrhea— gingivitis	10	34	4	48
Chronic tonsils	16	8	1	25
Teeth	1			1
Carcinoma larynx		1		1
Thyroid disorders	2	7		9
Hodgkin's disease	1			1
Bronchitis	4	2		6
Arrested T .B.	2	1		3
Heart	2	14	10	26
High blood pressure	26	72	21	119
Paralysis agitans			1	1
Diabetes		2	1	1
Hernia	92	113	34	239
Syphilis	3	4	1	8
Back injury		1		1
Non-union fracture leg	1			1
Total	182	345	96	623

Total defects on risks	623
Risks—November, 1937	416
Under 40	151
40 — 60	207
Over 60	58
Risks May, 1938	397
Risks paid off	19

Total Employees:

November, 1937	6186
May, 1938	3828
Paid off	2358

NUMBER OF DAYS LOST ON ACCOUNT OF ILLNESS AND ON ACCOUNT OF ACCIDENTS AT DELCO PRODUCTS FROM SEPTEMBER, 1928, THROUGH 1937

Year	Average Number of Employees	Illness	Accidents	
		Days Lost	Accidents	Number of Days Lost
1928	2735	924 (4 mo.)	82	1184
1929	3599	8821	65	1100
1930	3041	6799	23	555
1931	2826	6083	12	190
1932	2748	7488	4	47
1933	3537	6738	25	429
1934	4735	12968	50	798
1935	4969	11014	34	851
1936	5075	12181	30	582
1937	6164	12324 (days paid after first week.)	36	587 (days off starting first day)

thousand were referred to family physicians, oculists, and dentists in the past year. Placing of handicapped workmen is both efficient and humane. I would like to see better x-ray and laboratory facilities. Plant hygiene must be thorough. Good men could well be encouraged to specialize in this work. A smoothly running medical department will continue to be one of the factories' best personnel contacts.

Our planned attack, then, embraces the following features:

Careful original selection of employees.

A record system with visible reminders. Periodic re-examination. Information confidential.

Health education, principally by direct contact and advice; no "must" program.

Complete cooperation with the family doctor, actively initiated by the plant physician.

We would like to include a more active inquiry into syphilis and tuberculosis.

Sickness in Industry

R. B. ROBSON, M.D.,
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Windsor, Ontario

IT IS indeed a privilege to present a paper dealing with "Sickness in Industry" to this group of the profession whose daily occupation is principally concerned with industrial medical and surgical service. I consider the privilege the greater for the reason that I am in charge of such service in one of the smaller units of the corporation. The fact that it is a small unit gives me the advantage of knowing more intimately the individuals employed in the plant than might be the case if the unit were much larger.

My decision to initiate certain statistical studies pertaining to the subject of this paper was created by a statement made by Dr. C. D. Selby in his address before the American Medical Association in Atlantic City last year when he said: "Industry has little conception as to the cost or importance of ordinary sickness."

The factory operations carried on at the Windsor plant are chiefly the making of motor parts and the assembly of motors. There is no industrial disease hazard. The plant buildings are modern as to lighting and ventilation. Employees are chiefly Anglo-Saxon, and the average age is 35.5 years.

At the outset it must be thoroughly understood that authentic statistical data relating to many phases of this subject upon which to base sound conclusions are almost impossible to obtain, particularly as applicable to that part of the Dominion of Canada in which our plant is located. However, I submit that even a more or less casual consideration of certain definite results is more than sufficient to indicate the enormous economic loss both to employer and employee as the result of sickness; results which I believe challenge all concerned to explore every channel in an endeavor successfully to cope with this problem.

It is now necessary to give certain statistics with respect to the experience in our plant in order subsequently to appraise results and develop the thought that more intensive preventive measures are justified.

Breaking down the direct causes of this lost time due to non-industrial injury and illness in our plant we find:

TABLE I.
EXPERIENCES

	1936	1937
The average number of men employed....	355	516
The number of days lost during the year from non-industrial injury and illness....	1,107	1,316
The number of men who lost such time..	270	519
The average number of days lost per employee through non-industrial injury and illness	3.118	2.546
A limited study made by the American College of Surgeons covering 116 companies in the United States in 1936 disclosed days lost per employee through non-industrial injury and illness.....	8.85	

While our experience in 1936 of 3.118 days lost per employee is substantially less than 8.85 days quoted by the American College of Surgeons, nevertheless I submit that further exhaustive research is justified. In fact it is an obligation on the part of industry, to alleviate this condition. Great strides have been made in the past few years in the reduction of industrial accidents but the loss of time from non-industrial injuries and illness is quoted by the American College of Surgeons as being, in 1936, 15 times as great as that from industrial accidents.

And now there is the task of endeavoring to estimate the economic loss due to non-industrial injuries and illness. As an example, I shall use

TABLE II.
LOST TIME

	Number Employees	Number Working Days Lost	Number Employees	Number Working Days Lost
	1936		1937	
LOST TIME OF 8 DAYS AND OVER:				
Pneumonia	4	147	4	115
Heart affection	2	94		
Scarlet fever			2	76
Influenza	5	73	5	44
Duodenal ulcers	4	71	3	58
Appendicitis	3	60	3	60
Others	8	146	3	42
	26	591	20	395
LOST TIME LESS THAN 8 DAYS:				
Common colds	94	134	351	451
Influenza	58	153	85	295
Stomach complaints	30	62	5	10
Sore throat	22	51	1	5
Non-Occupational accidents	2	5	17	42
Backache	10	34	8	23
Others	28	77	32	95
	244	516	499	921
Total for year	270	1107	519	1316

our own experience for the years 1936 and 1937, quoting figures published by Dean K. Brundage of $2.63 per capita as the cost for medical care on account of ambulatory cases, plus a cost of $1.00 per person for disabilities of less than one week's duration in families whose annual income in $1200 and $2000. This takes no account of hospitalization costs and utilizes the same cost for all illness irrespective of the duration of such. From the same source I quote: "It may be assumed that the cost to the employer is at least 1½ times the amount of the daily wage when experienced employees are incapacitated by sickness." Our experience would thus appear to be as in Table III.

I have the following observation to make with respect to this all-important work of the prevention of lost time due to non-industrial injuries and illness.

TABLE III.
LOSS OF WAGES THROUGH NON-OCCUPATIONAL INJURIES AND SICKNESS

	1936	1937
1937 — 1107 days	$ 7,441.58	
1937 — 1316 days		$ 9,218.58
Medical Cost:		
1936 — 270 employees	980.00	
1937 — 519 employees		1,883.97
Cost to Employees	$ 8,421.68	$11,102.55
Cost to Employer:		
1936 — 1107 days	11,158.56	
1937 — 1316 days		13,788.00
Economic Loss	$19,580.24	$24,890.55
Cost per Employee	55.15	48.23

Pre-Employment Physical Examinations

IT IS generally accepted that the pre-employment examination is most essential. This initial examination, the first contact with a prospective employee, should be most thorough and exhaustive. Physical defects, if any, the effect of such on the man's employability, and the type of work for which he is best suited must be ascertained. Such factors are not only important to the man but much more so to the employer if we are to insure a proper proportion of physically fit man power in our plant. This man may become our industrial responsibility for a long period of years, hence the importance of most searching investigation at this time. Above all other factors, it is at the time of the pre-employment examination that we must gain the implicit confidence of the man by impressing upon him our sincerity and concern for his welfare. If defects are evident, it is now that such should be frankly discussed with the man. The man must be made aware that the examiner is conversant with such defects. Furthermore, I submit that *all* prospective employees should be subjected to pre-employment examination irrespective of their probable status in the organization.

Determination of the Cause of Absenteeism

MY EXPERIENCE has proved that the services of capable nurses to investigate every employee absence are productive of greater all-round beneficial results than any other means of ascertaining the true cause of absence. Moreover, the interpretations which a tactful diplomatic member of the nursing profession can place upon her observations are not only beneficial as to the specific cause of absence but in numerous instances will also prove very informative as to the home life of the absentee and frequently shed new light or confirm previous opinion with respect to the probable cause of the employee's condition, etc. Dr. Newquist, in "Medical Service in Industry and Workmen's Compensation Laws," states: "While the purpose of home visitation is to render any needed assistance, its concomitant effect in reducing absenteeism due to unnecessary personal reasons is highly desirable."

Periodic Physical Examinations

HERE again, the periodic examination should apply to every member of the organization if the maximum beneficial results be hoped for. Particularly should this apply to the executive group upon which rests the responsibilities of management. A health audit of such members of the organization every six months is not too frequent, and other employees as frequently as in the judgment of the plant physician such be desirable.

It is of the utmost importance that such examinations be never conducted in a perfunctory manner. The pre-employment examination having been conducted with the thought of creating confidence in the man's mind, it is doubly important that the periodic examinations should be so carried out as to maintain that confidence. It is undesirable for the plant physician to conduct

such an examination if he be worried or seriously concerned about some other patient. The employee up for examination can frequently sense such abstraction much more quickly than the examiner may realize, with the probable hazard that the employee may not respond in confidence as might otherwise be the case. There must always be sufficient time to listen sympathetically to a detailed description of, for instance, the illness of the employee's wife, or some member of his family, for there are frequently reasons here disclosed to account for loss in weight through worry or the contracting of some communicable disease. I find that the ability to listen to the stories of the home life and all its seemingly endless troubles, especially from those in the higher wage brackets, no matter how tiresome the recital may become or how anxious I may be to get on with other work, may reveal the cause of a beginning hypertension, a bit of precordial pain or a distressed gastro-intestinal tract.

Re-Examination Following Absence

EMPLOYEES returned to the plant following absence from illness or injury should pass through the hands of the plant physician in order to determine their fitness for duty, either as previously employed or on some different type of occupation.

Furthermore, it may be desirable for the plant physician to impress upon such an employee the necessity of proper care of his health while at work, the possible need of additional rest after work and particularly over week-ends until full health is regained. I have not lost faith in the fundamental honesty and integrity of the average employee, and I believe there are still many men who will minimize their feelings of weakness in order that the pay envelope may be bolstered to help take care of a hungry family.

Frequency of a Particular Disability

IF IT becomes apparent that an abnormal number of cases of common colds be in evidence in the plant or a particular section thereof, it is the duty of the plant physician not only to recommend that appropriate treatment be administered by the family physician of the employees disabled, but, furthermore, to endeavor to ascertain whether or not some condition exists in such location which might be the cause of, or a contributing factor to, such disabilities. Ventilation, over-crowding, temperature, etc., may have a decided bearing on such a condition. The industrial physician is obliged to search for the cause of such disabilities and particularly to insure in cooperation with other plant executives whether or not prevailing conditions in the plant be such as may be conducive to such a disabling condition, and, if such be the case, then make every effort to overcome the deficiency.

Cooperation with the Family Doctor

THIS is perhaps one of the most important steps in the whole task of sickness prevention, and it has been laid down for some time and often emphasized that the doctors of the General Motors Corporation are not in the practice of medicine so far as the treatment of illness of employees is concerned. There is a tendency to believe in certain cities that the industrial physician is inclined to poach upon preserves of the family doctor. To obviate misunderstandings with the family physician it is essential that the industrial physician meet and know him, attend the local medical society meetings, and take part in the presentation of papers therein when the opportunity presents itself.

When a defect is found in the course of a periodic or special examination which requires sending the employee to his family physician for treatment and medical care, it is most advisable to communicate with that doctor and inform him that you are recommending to the employee that he consult his family doctor. Inform the family physician what you have found and suggest that he in turn advise you of his subsequent findings, and assure him if there is any assistance you can give him either in watching the patient or having him report back to his doctor, you will be glad to do so. I find that where the situation is handled in this way, my relations with the family doctor are most satisfactory, while, on the other hand, if by chance I fail to advise the family physician in advance of the employee's visit, complications may occur. In such circumstances I have made the wrong approach and have not only lost face with the family physician, but may also have lost that which is exceedingly difficult to regain, i.e., the confidence of the employee. Truly as Dr. Newquist has stated: "No health program can be effectually completed without the cooperative working relationship with the private or family physician."

Briefly to summarize my views on this most comprehensive subject — as to which I have touched on a few of its many phases—I would say:

1. Much greater importance and attention must be given to the proper and accurate recording of all details concerning absenteeism in order not only to know the condition existing at a given date but also to be in a position to judge progress as time passes.

2. It is imperative that the confidence of the employee in the sincerity of the plant physician and the retention of such confidence be insured by conducting the medical duties in a manner that will continue to engender the spirit of friendship between the two parties, and never breaking confidence.

3. It is most essential that the greatest care be exerted with the family or private physician to the end that the cooperation be assured which is so very necessary between these two parties for the good of all concerned.

4. The whole-hearted cooperation of the management, including particularly the safety and personnel departments, is a fundamental requirement. As Dr. Newquist has so aptly stated: "Above all the medical department must have the whole-hearted support of the official management; without it, no industrial medical service can attain maximum efficiency."

Present Status of Disease in Industry

ROYD R. SAYERS, M.D.,
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ACCORDING to the dictionary, hygiene is the science of health and its preservation. Industrial hygiene is the science of health preservation among workers.

Occupational diseases are variously defined. Some states define only one disease and that only under very certain circumstances. It might be that disease is only an occupational disease by the election of the operators and the union. And another state may have a list of diseases which were said to be occupational diseases, but silicosis was not an occupational disease because the law in one state did not so state. Occupational disease can be defined as a disease arising out of or in the course of work or occupation.

Dr. Selby called your attention to the fact of occupational injuries as such, and that includes not only accidental injuries but occupational diseases causing a very small fraction of the time lost due to illness of any worker. He called your attention to his statistics, which show about six-tenths of a day per annum per man is due to occupational injuries, while eight, nine, or 10 days is the total lost time from all illness.

We are quite hesitant about using these statistics, and that makes me think of the remark about the use of statistics that some use them like a drunk uses a lamp-post, for support, not illumination. We hope to use these for illumination.

We have no difficulty in finding facts, data, on which we can base a real program of health maintenance, of health preservation. When we come to look for data we have four or five places to which we can turn and it is fragmentary even in those places. One of them is the compensation laws of our states and of the country. These are quite inadequate and obviously do not cover all the diseases. Eighty-five per cent of the compensation cases for industrial diseases or occupational diseases are for skin diseases, dermatoses.

The next source of data is from the mortality statistics. It is difficult to get occupational mortality statistics, but a number of years ago and more recently the death certificates of several thousand people have been studied in Indiana, Illinois, Nevada, Wyoming, Arizona, Mississippi, etc. An accurate rate cannot be made as the industrial population is usually unknown. Therefore the only thing we can get from those data is the proportional death rates.

Another source of information is the records of sick benefit associations. Seven days or less are seldom recorded by these organizations.

Careful surveys have been made by the Division of Industrial Hygiene of limited numbers, samples, if you will, in which we learn something of the incidence of illness among small groups of people. These are useful.

Mr. H. R. Britten of the above-mentioned Division of the Public Health Service made a survey in one industrial community in which he compiled and analyzed the illness data and concluded that so far as he could determine there were often factors other than just the environment and conditions under which people work that were more potent in the production of disease than was the particular working condition.

Accidents have been referred to several times. The facilities for securing records of accidents in industry are very much better than for other illness. There are not more than 19,000 deaths per annum in all the industries of the United States, but there are about three million lost-time accidents. It is estimated that illness causes six to eight times more lost time than accidents, and I think that is a very conservative estimate. And there was an estimate made this afternoon as to the cost of this. It cost in decreased earning capacity an estimated two billion dollars from illness, which can be prevented.

Physicians in private practice, public health officers, or industrial physicians, working as individuals, cannot make much headway. That is the work we are all going to do more in the future. We must work together if we are going to succeed.

I think I have indicated to you some of the places where we might get better data. Dr. Selby has shown me today through those that are working with him that they are obtaining information by keeping statistics of all absenteeism due to illness from all causes. In one group which Mr. Brundage of the Public Health Service analyzed they had records on all the illness because this particular company paid wages during illness to all their employees. They had more absenteeism due to illness under those circumstances than in the circumstances under which most companies operate. In this statistical analysis of 4699 individuals it was found that 80% of them, or 3784 cases, were six days or less and that 64% of them, about 3000 cases, were three days or less. To control or maintain health among groups, knowledge of where, when, and how a disease is occurring must be available. I will go on just one step further and take up a few of the specific diseases that occur among groups. Usually we don't know of specific diseases until there is disability, and our mortality statistics seldom indicate the inter-current or associated diseases. In one year in Washington, D. C., in 650 deaths due to heart diseases of various types, the diseases associated with these cases were: arteriosclerosis, hyperthyroidism, etc., which really meant that if these cases had been seen at an earlier date, heart disease might have been prevented and death postponed.

We heard today methods of finding the cases and the methods of taking care of those cases, and that is part of the job of the medical profession

and I don't mean just the private physicians. I am including industrial physicians and health officers in the solving of that problem. It isn't just the finding of the case. It is our job as physicians, to take care of the case after it is found. The case, if found in a minimum stage, before it becomes a disability case, can be cured and usually cured promptly. Furthermore, the case can be removed from association with other individuals who are susceptible. That makes me remember a statement that I heard the president of the National Tuberculosis Association make. He stated that over 90% of men such as myself, when we came to adult life and went out into industry, had had tuberculosis of the adult type. In the younger groups we have been doing child hygiene, school hygiene, taking care of them until they get out of the university and what is the result. Today, according to the above-quoted source, 90% of men coming out of schools into industry have not had adult type tuberculosis. They are in industry in their most susceptible age group. The cases should be found in the minimum stage in order to protect them and their families. There is follow-up work to do. We could talk on that almost indefinitely.

As you notice, I have not talked occupational diseases practically at all this evening. Not because they are unimportant, but because industrial physicians in large industries such as General Motors, know how to control most of them. There are other problems, plenty of them. We would be glad to discuss any one of the occupational diseases that seems necessary to discuss. This problem which includes occupational disease is of far more importance and is a problem for us all. It can only be solved by us all.

Let us take as another example a disease in which Surgeon-General Parran is most interested. I believe that we can all agree that it is not an occupational disease. That disease is syphilis.

Syphilis in one group of over 36,000 was found to have the prevalence of 4.2%, and in another group of 27,000 white men, 8.9% serological positive. One industrial physician has been making an examination of a group over a 10-year period. About 5% were positive when he began. The incidence rate is now about 1%. He sees that all cases of syphilis receive treatment. Every man who works for that company has periodical examinations. They do not discharge a man for having syphilis, but adequate treatments must be taken.

I have emphasized that the desired preservation of health among workers can only be met by the cooperation of all those interested, the employers, the employees, but most important, the physicians in all fields of the profession.

Medical Research in Industry

C. F. KETTERING,
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Detroit, Michigan

OF ALL the people in the world that I admire, there is none that I have any keener admiration for than the doctor. That is for two reasons: First of all because of the long period of training which he must undertake, and next, the absolutely hopeless cause he represents after he gets through. Every time the stork rings up a count, the undertaker makes a new coffin. Old Man Time is the one that you battle, and necessarily battle unsuccessfully. But you have this great consolation that, if you can pull the boys through the three score and ten, you are not responsible for what happens after that.

Now as engineers, sanitary engineers, doctors have done a marvelous job, and you gentlemen have done a work which merits the respect which I am sure you get of the community in which you live. You have a real problem on your hands, and I think it is remarkable the doctors have done as well as they have. You have been expected to take this complicated mechanism called a human being, and besides knowing the chemical and physical requirements, you have to contend with psychological and mental hysteria and everything else, and you have to prescribe a pill that will be effective. I do not think you are magicians and I don't think you want to be.

Where are we in this whole picture? We have heard something tonight of the inefficiency of statistics and statistical averages, and the fact that statisticians often used them as lamp-posts to hold themselves up and not to help them. I happen to know a good lamp-post story which fits in with that one. A gentleman had come from a Y.M.C.A. meeting one night, and as he got out of the taxi, he reached in his inside coat pocket, took out his pocketbook, and paid the driver. In putting it back he evidently missed the pocket, and he lost his pocketbook. He was searching around under the lamp-post with a cane—it was in the Fall of the year and the leaves were all over the ground—and he was pushing the leaves around when a friend came up and said: "Did you lose something?"

He said: "Yes, I lost my pocketbook."

The fellow said: "How did you come to lose it?"

"Well," he said, "I came from a meeting at the Y.M.C.A. and I paid the taxi driver and put my hand back in my pocket and missed my pocket and lost my pocketbook."

The other man said: "Where were you when you paid the taxi driver?"

"I was right down there under that tree."

His friend said: "Well, what are you looking up here for?"

And the man answered: "Well the light is much better up here."

We are likely to put statistics in where the light is best.

Here is an example of what different problems you have today with this complicated system of organic chemistry and physics and engineering and everything else combined. About two years ago, there was a symposium prepared on the effect of radiation of biology. That in particular, had to do with the effect of sunshine, light cures, etc., and whether or not you should get outdors and let Doctor Sun do the work or whether you should see a doctor once in a while. There are two nice volumes about that, well written, and I read them because I happened to be a contributor. I am glad to say my contribution is just as worthless as the rest, and the reason for it is this: When you got all through with the book you could say: "There is something in this book we do not know. Because when the biologist did the experiment he did not control either the chemistry or physics of it, and if the physicist did the experiment he did not control the chemistry or biology." So all the way through there were two uncontrollable factors in every one of the experiments. Consequently, the data weren't much good, but there were some generalities which did deserve attention and which could be measured, if, as, and when we recognized that we had to work as groups on this thing rather than as individuals.

I HAVE been interested in this field of industrial medicine for many, many years. In fact, I came from an institution, the National Cash Register Company, in Dayton, who were one of the very early people to put in a study of industrial medicine and industrial conditions. Incidentally Dr. Herman, who is the doctor who examined me for employment there many years ago, is still the doctor in charge. He is one doctor who has prolonged his own life as well as those of the people he was treating, which hasn't always been the case. Nevertheless, one of the fundamentals of that institution was the health of its employees. I learned a lot about that. After I had graduated from National Cash Register, I started my own organization, and many of the ideas we carried over there were things we had learned at N.C.R. We tried to carry out this industrial control of medicine. We also put in dental clinics and things like that because we felt that we could at least try to catch troubles at the start, which is so important if the doctors are to do a good job. You cannot wait to call the doctor until it is time to call up the undertaker and expect to get results any more than you can by calling an insurance agent when smoke is coming out of the house. We have to get ahead of this thing if you are to do the jobs you have to do.

Now there is an enormous problem here and the work has been done very well. There are lots of problems yet ahead of us. As some of you know, I am interested in some medical research at the Miami Valley Hospital—fever therapy in particular. The way I happened to be interested in this was purely accidental. I drove down to Dayton to a meeting with the refrigerator people, and got in there Friday at noontime. I stopped at a hotel to have a bite of lunch and the doctors were having a meeting. They said: "Come in and have lunch with us." I knew them and I did. They asked me the question: "What do you think is the biggest problem of practicing physicians?"

I said: "I don't think the problem is any different from any other man's who is working in technical applications. I think the biggest problem anybody has whose work is of a broad technical nature, is how to keep up to date and still earn a living. If you are going to take time to read all the papers that have to do with your particular profession, you have no time to work, and if you are working and paying no attention to reading papers, you are going to get out of date. There is no happy medium there."

They said: "Well, how do *you* do it?'

"I happen to be lucky in my particular case. I have working for me some 20 fellows who have been with me for years, and they know about what I know. Consequently, if they read an article they will say: 'Here is something he doesn't know.' And they can mark it and have a photostat made or send the magazine in. When I come in the boys have a pile of magazines for me with little feathers marking articles. Here is an article that is 15 pages long and one paragraph of new stuff is marked and that is all there is to it. I have 20 fellows reading for me."

So they said: "Well, how are we going to work it here?"

I said: "I don't know. It seems that you have to do the same thing. You have to get some fellows to do the reading for you and keep you up to date."

Well, the meeting closed there and I went on my business. Some two weeks afterwards, Dr. Martin Fisher, of the University of Cincinnati, was giving one of his talks in Dayton and the boys asked him about it. He said: "Well, it is a new idea and I think it is worth trying out." So they came up and told me that Dr. Fisher approved of my scheme—I have a profound respect for Dr. Fisher—and they said: "Well now, we know how to do this and we have got everything but the money." So I said: "Well, I think we can fix that." So I underwrote that little experiment for a period of five years with a renewal clause for five years more. And it has worked out very well.

That was really how I got started in this fever therapy work. With Dr. Walter Simpson, a pathologist, we started out in a simple way to do this work. The thing expanded. We tried one little experiment and another little experiment, and it gradually grew into this present program of experimental medicine that we are doing down there. Fever therapy is one of the things which you know a lot about, so I won't take any time on it.

We have not been interested in selling anything. We have only been interested in trying to find out what were the factors that had to do with the giving of artificial fever, and what could you do with it, and what couldn't you do with it. We cannot publish all of the things we know because there are a lot of people who would take advantage of them, the same way they did with x-ray. A few years ago, no matter what was wrong, they gave you an x-ray treatment, with the result that the whole effect of the x-ray was set back 10 or 15

years. That would not have happened if it had been handled in an intelligent way.

I have been interested in industrial medicine for another reason, because in industry you have a chance to contact, under organized methods, a large number of people. Therefore, by virtue of the employment contact, you can have certain medical examinations in which you can get group reaction rather than the individual patient whom you meet in your daily practice. Now there is no conflict between industrial medicine and private practice, because in the many years I have operated in industry we always brought in the doctors to work with us. On anything of this nature there are specific items which can be capitalized on for the benefit of the patient, the doctor, and the community.

SO MUCH for our trade, so to speak. You gentlemen have your paper here, your trade paper, and it is just exactly the same as the S.A.E. paper. We have the Automotive Society, Chemical Society, Physical Society, etc., in which the specific details of the specific professions are brought up, and I presume that you have about the same degree of harmony and agreement that we have in our ordinary engineering. Just before I came here today, I sat in a meeting in which a fellow was talking about certain research investigations that had to do with social and industrial relationships, and he said that the greatest difficulty was that we could not get in agreement as to what the data mean. "Well," I said, "that is very, very unfortunate. In industry where we work with a chemical balance, delicate machinery and the most exact information in the world, we cannot get any agreement on what the data mean, so I don't see why you should worry about that." Some of the Buick people here will remember that we tried to work out a means of testing engines seven or eight years ago. We tried to get the boys to measure the compression of an engine, which is about the most elementary characteristic of an engine. We could not get in agreement so we took an engine and put it on a truck together with every bit of instrumentation that had to do with it, and we shipped it around to the five Divisions of General Motors. There was 100% difference in the instrument readings of the five Divisions on the same instruments. Well, if you cannot have agreement on that I think you fellows will probably have your disagreements too. The whole difficulty is the fact that we are human beings. You could get around a lot of that if you wanted to go out where there weren't any human beings, but it would be so uninteresting I would not want to be there. I would rather work with the human being, even with his peculiarities and everything else, and be associated with folks, than to be out on a desert island by myself.

What is the future of all this—of industry and medicine and the correlated great health program which you men are interested in? I think we are just in the beginning of it. There was a man in our office this morning talking about the World's Fair in New York and the looking-forward program, the World of the Future, which that Fair is centered about. I said that you cannot make any prophecy as to what you expect in the future without getting a few mistakes, but it pays to know where the arrows point. You cannot get the directions from one case, so let's go back and see where our industry and our accomplishments came from in the past. Let us take this great electric lighting industry — where did that start from? Well, that started from a fellow by the name of Edison who believed that he could take a filament and put it in a bottle and have the current divide between a half dozen of them. He had a terrible time. We have forgotten about most of that because all we do is press the switch and the lights come on. The bills are perhaps too high — and maybe they are not. It doesn't make any difference, it is the same thing anyhow. We had all of this marvelous information at our hands, but all that stuff is just as inactive and lifeless as the rocks out there in the quarry until somebody does something that makes it workable.

Suppose we go back 50 years and see if we can spot a few of the points on this arrow. Let's take those 50 years in your profession. Let's go back 50 years and see what chances a patient had then.

I don't know anything about it. I couldn't go back and allocate what you knew and what you didn't know 50 years ago. I could say what you know and what you don't know today. Maybe it isn't very much different from what you knew 50 years ago, but, nevertheless, I would very much rather be sick as of today than 50 years ago.

Now, we have all these complainers, who say: "I think we have developed technologically too fast. I think we have gone too far." I always use you fellows as an example to refute that. I say: "Let's take the medical profession. They have done wonderful jobs. How much too far have they gone? I am sick today. You are sick. How much less good medical attention would you like to have? How many years back would you like to go? Suppose you got a strep infection. Would you like to go back five years? Sulfanilamide has made a wonderful difference in strep infections and it's less than five years old." How far back do you ever want to go in any of the things that you know today? You don't want to go back one day.

Just before I left my office, just 10 minutes before, there were delivered a couple of new books which I had ordered, on "Advanced Organic Chemistry." I threw the books in the car, because I thought I would look at them as we drove out to the Proving Ground and then over here. One of the things I particularly looked at was a chapter on proteins. You know, the dietician today knows all about proteins and hydrocarbons, but those words have just as specific a meaning for me as the word "scrap-heap"—just as definite as that. So I thought I would look in the very latest book gotten out by the American Chemical Society on "Advanced Organic Chemistry." I opened the book and said: "Now I will find out what a protein is." The book defined it: "Protein—a very ill-fitting term for a little-known organic compound containing nitrogen." So I thought that my "scrap-heap"

was a pretty fair illustration. Yet the expert dietician today who says you can't mix hydrocarbons and proteins knows it all.

ONE of the biggest things I think is going to develop in medicine is that we are going to have physicists and chemists and bio-chemists and biologists working with us. We have a research project, a very interesting bit of research work, at Antioch College. I say its purpose is to try to find out why grass is green; and gentlemen, if I never get anything else out of it, the peculiar points of view in letters to me, as to why I don't know why grass is green, are worth the price of admission. I had one from Germany today, a rather longish letter, and it said: "My dear Mr. Kettering, don't you know the reason grass is green is because of the green in the chlorophyl?" Well, he had written to Dr. Martin Fisher and Dr. Fisher said: "I think Mr. Kettering is aware of the fact that grass is green because of the chlorophyl in it, but what he is interested in is why chlorophyl is green."

The reason I am interested in that is this: Not because I am interested in why the grass is green, specifically, but the only reason that you are here is because grass is green. The only way that we can stop the energy from the sun and hold it here for our use is by means of the work done in the green leaf of a plant. It takes the water and the carbon dioxide, breaks them down, and builds up those marvelous carbohydrates and proteins about which we talk so glibly and know so little. Right there is the basis of all biology, so we started out to see if we could find anything at all about it, as to how it is done. What is the mechanism in the life of that plant by which the energy falling from the sun can be utilized and stored up? I am going to tell you a couple of problems involved in that, because you, as doctors, will be interested.

PROBLEM NUMBER ONE—Given a planet like the earth, with a temperature entirely too high for any of the ordinary biological compounds to exist. It starts to cool down. If you had the job of starting biological work there, what would be the inorganic set-up you would put in there, which, plus the radiant energy from the sun, would break down the first molecules of carbon dioxide and water vapor, giving you the beginning of creation?

PROBLEM NUMBER TWO—Let's take any human being, Jim Jones, for illustration. Who is Jim Jones? Is it his eyes, his ears, his nose, his arms or legs? Well, let's draw an organization chart of Jim Jones. Down here are the departments—the department of breathing, that is the lungs; the department of pumping, that is the heart; here is the department of something else, that is the liver, the kidneys, or the stomach; here is the department of seeing, the department of hearing. Who governs them? Well, they now say that certain secretions in the pituitary gland belong here at the top of the chart. That is Jim Jones. So in addition to the functional things, which are the lungs, the heart, blood, and other things, you have those ductless glands, those small things which determine so much and which chemistry is just beginning to learn a little bit about. Up there too is adrenalin, and then the thing that controls adrenalin; insulin —the addition of a little bit of zinc makes a tremendous difference. So we are just on the threshold, in the kindergarten phases, of knowing anything about the complicated biological chemistry which you gentlemen are asked to be so profound in.

This is for the newspaper boys: Don't go and write up that these doctors don't know anything about what is wrong with you. Not because they do, but because it is so sad to die under the care of a doctor who doesn't know what is wrong with you. They know all that the world permits them to know, and what you can say of medicine you can say of every other thing.

Look at Mr. Curtice's automobile. I think of this, since it is such a warm evening, especially in here. I had to invent a thing a long time ago when he was not yet with Buick. They had the twenty-fifth anniversary of the Buick motor car. It was a terribly hot day in July, and they had the meeting up in the Technological Building. I was one of the speakers, one of the last speakers—they always have the acrobats at the end. One gentleman got up and said he didn't think that as long as the Buick Motor Car Company lasted they would ever make a better motor car. It was to stop that point of view that I invented "The Automobile in the Glass Case."

Mr. DeWaters and all of the boys who had to do with designing the Buick were sitting down in front. "Now," I said, "you gentlemen pick me the best motor car you can make—not the kind you build, or the kind you sell to your customers—one of the super deluxe kind they let the management drive. Let us set it up here on the table. It is perfect, paint job is perfect, upholstering is perfect, engine is perfect, transmission and everything. Let's put it in a glass case, and on the outside—or rather on the inside—we will put the price—$1,500 or $2000, whatever it is, just like they used to post the stock on the bank door. The understanding is that under no conditions will that motor car change one bit from the day we put it in there. It is hermetically sealed. A year from today, let's look at that car. It is as good as it was last year. But the prospective customer says: 'It was a good car, but the price is too high. You say $2,000. I will give you $1,800 for it.' Let's come back every year, and at the end of the 10 years, what do we have? Here is this same beautiful motor car. 'But,' the customer says, 'the junk man is the only fellow who will pay you anything for that.' "

Why? Because the motor car depreciated? No, it couldn't depreciate in the glass case. It was the appreciation of new car designs. They had appreciated in 10 years equal to the total value of that car.

That is true clear across the board of every endeavor of humankind. Today it is the best we have, and tomorrow not quite good enough, and day after tomorrow not quite that good, because we know so little about anything. That is not criticizing the many who came before, but it illustrates how well we use what we have.

The other day we dedicated, down at the Edison Institute in Ford's Greenfield Village, the moving of the Wright Brothers' shop from Dayton to there.

In that village Mr. Ford has Mr. Edison's laboratory and various other things. A great many of the aviation fellows—the top-notch aviation fellows—were there; the first pupils that Mr. Wright had taught were there. This was the first generation of aviation still remaining; the first pupils of the man who had devised the machine, who had made the invention. We also had some of the latest and best models of the aviation craft of today. The interesting thing was this, as I stated to a group of fellows at lunch that day. I said: "Take this last five-year group of flyers right out here. Show them the original Wright machine to pass their opinion on, and they'd say, 'That thing won't fly.'" Why? Because they knew too much! They couldn't have gone back and flown that original machine, because the new technique in aviation over the past 25 or 30 years had developed to the point where they wouldn't take a chance on that original flight. But if that original flight hadn't been made, this last 300-mile-an-hour flight would not have been made.

So if anybody says to you that technological development is being side-tracked, pay no attention to it. It is not being side-tracked in your business. You don't know anything today from which you would let a man die if you knew the remedy. There isn't any surgeon today, if he knew the operation, who would let a patient die.

THAT is almost universally true throughout industry today. The public is getting, in every respect, the last bit of information that is available to do the particular stunt that is to be done. But that doesn't say how much of the sum total we know. I want to tell you a little story. A great many of you know about benzine and benzine chemistry. You can also remember back only a few dozen years ago, when they synthesized indigo, and there was a great furor, because Nature had made that compound, and therefore, mankind shouldn't try to synthesize it. That was the beginning of synthesis. Most of the developments in synthetic chemistry have been around benzine. I don't know the exact number, but I presume there are over 100,000 benzine derivatives. We have recently, in this chlorophyl work we have done at Antioch, produced in considerable quantities a material known as porphine. That is of great interest to you as doctors, because porphine is the simplest basic molecule common to both chlorophyl and the hemin in the blood. The principal difference between chlorophyl and hemin is that in the chlorophyl molecule you have an atom of magnesium, and in the hemin you have an atom of iron. That is how close to vegetables we are.

Now, this fundamental porphine is the common biological unit which bears the cross for both of them. Whatever benzine is today, porphine chemistry is quantitatively at least five times as great, so if we have 100,000 benzine derivative compounds, we are going to have 500,000 porphine derivative compounds. They have this great difference—porphine is light sensitive. Consequently in addition to having 500,000 compounds, you are going to have 500,000 compounds that will have some selective effect in conection with radiation, sunlight, etc.

It is a new universe. I am mentioning that because in this book, two volumes, something like 2,000 or 2,200 pages on "Advanced Organic Chemistry," the word porphine apparently is mentioned twice in the whole text.

Your business and our business has just begun, because as we learn to know about these compounds, as we learn to know what protein means, what carbohydrate means, we are going to have a better comprehension of the thing we call life. We are going to have a better comprehension of all of the things which have to do with public health, with hygiene, and everything else.

The work done on syphilis was mentioned earlier this evening. That is just simply a question of becoming conscious, of getting these things put on the calendar. If you have them on the calendar and recognize them as problems, somehow or other they automatically get solved. The problems that don't get solved are the ones that we don't pay attention to. It works the same way in any research business. People say: "What is research?" I say it isn't anything but a state of mind, not a laboratory, not a chemical balance, not a test-tube. It is this: Are you perfectly satisfied with everything that you are doing, with yourselves, with your profession? If you are, you have no need for research. If you are not, here is the fundamental procedure:

Take a tablet or a blackboard or a piece of paper, and write down 10 things on there which you are dissatisfied with. If your business is medicine, and write down 10 things there which you are tice of medicine? Ten things you don't like about yourself, about your patients, about your remedies, about your surgical instruments. Write them down, and the very fact that you write them down means that you are going to do something about them. Now, maybe you can't solve Number One first, because they are just like crossword puzzles. Maybe Number Seven or Number Eight you can solve. You rub it out. You say you can do something about that. Then you pull them all down and put a new one in. Somehow or other, over a period of years, by only being conscious that you have these problems, they get solved. They don't get solved as long as you are not conscious of them. It seems to me that medical meetings such as this, if they don't do anything more than make us conscious of the problems we have, are worth it.

We have just recently started a new thing in General Motors. It is not really new. It is 40 years old, just as old as the automobile engine, but why didn't it come? Because we weren't conscious of what its difficulties were. So a number of years ago, I wrote down on the wall some of the difficulties of the Diesel engine, and said: "Can we lick any of them?" We scratched one out, and two or three years later, scratched another out. So today, from our development of the Diesel engine, we are presenting an engine which, for the same horse power, weighs less than the gasoline engine, and is smaller. You tell that to any old-time Diesel engine man, and he will tell you you

are a liar. But don't take our word for it; talk to the engine. We don't deserve any credit for that. We did it by that logical way of writing down and recognizing what the problems were, and seeing if we could get around them. One by one they fell by the wayside, but not without a real struggle, a lot of work. So that the thing we regarded five or 10 years ago as an absolute impossibility is today a reality.

That is the process of all human development. There is no magician in this business who can take a hat and pull out the solution; but if every individual in the profession becomes conscious of the real problems they get solved.

I would considerably sooner have 50 or 100 or 200 men such as in this meeting conscious of a thing that needs to be done than have the greatest scientist in the world conscious of it by himself. Consequently these meetings are worth while. Whatever you get from the papers which are read, that is one thing, but that is not the important thing that you are going to take away with you. "Yeah, we had a good meeting. Doc Jones read a swell paper, it is something I never knew about." But what you take back from this meeting that is going to work with you is something that you talk about on the steps. Something that you see as you walk through a building is going to make an impression on you; that is going to put some subconscious function of your mind to work, and it will result in an end which will be of great benefit. All we need to know is that we know so little. We know nothing about this great subject of biological chemistry. It is the most beautifully balanced thing in this world. Change the temperature a little bit, change this or that, and the whole thing is upset. We don't understand that, but that is not our fault. We are not old enough to know yet. It would be like criticizing people back 50 years ago for not knowing the things we discovered day before yesterday. Therefore, if we will do the best we can in the time in which we live, then we will have done a fundamental service to the communities in which we live.

Safe Use of Trichlorethylene and Other Degreasers

A. L. Brooks, M.D.,
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DEGREASERS and solvents are being used in ever increasing amounts from year to year. In the automotive field we are using paints, lacquers, and enamels of a composition and variety which were unheard of a decade ago.

The whole field of plastics is a relatively new enterprise. As tung and soy bean oil replace linseed and turpentine, new organic and highly complex hydrocarbon solvents replace the simple petroleum distillates and alcohols. As wood is replaced by metal we find the problem of degreasing a growing one. Sheet steel is shipped into the fabricating plants smeared with oil to prevent rust in storage and in transit. Before it can be fed into the presses it is daubed with drawing compounds. Flux is applied, and welding, brazing and annealing processes further alter the compounds and give rise to fumes. Seams are tinned, soldered, and filed. By the time a body is ready for cleaning in preparation for the prime coat, we have a mixture to remove that requires the best of solvents.

Research laboratories have been anticipating these needs and from the industrial standpoint the products they offer perform satisfactorily. Sometimes, to be sure, experience with a new product is so limited that we have been tempted to choose one the action of which on the human organism is not so well known.

I speak from the standpoint of one interested in automobile body construction, but I suspect that the same problems are encountered in the building of refrigerators, Diesel engines, hardware, and electrical equipment, and we know that the people who manufacture tires have always had their solvent troubles.

You are all familiar with the commonly employed solvents, yet at the risk of repetition, I would like to mention some of the most important, and classify them as to origin.

We will omit the alkalis and acids which can be used in certain rough solvent and degreasing operations, but which are not commonly employed in a large way.

The alcohols have long been used, but they have been replaced, except in certain varnishes, by the aromatic and aliphatic hydrocarbons, produced from coal tar and petroleum distillates respectively. Beginning with benzol, having the closed chain, and with methane which has the open chain, we can substitute the chlorine and other halogens, and juggle the hydroxyl, the phenyl, and nitro radicals, producing a variety of agents. Some of these substances exist in theory only, but others really materialize, and they either conform to our expectations as to efficiency and toxicity—or they don't—in which case we have to experiment with them. Some are too expensive for wide use. Others are efficient but highly inflammable or toxic, so they must be used cautiously. Among the least expensive are the petroleum distillates, but these like the unmodified group of benzols are fire hazards.

The chlorinated hydrocarbons, carbon tetrachloride and trichlorethylene, are not fire risks but possess other qualities which demand the exercise of caution. Since the matter under discussion relates principally to trichlorethylene, let us con-

sider the members of the chlorinated hydrocarbon group. These are prepared from the methane, ethylene, ethane, and propane groups by the substitution of one or more chlorine atoms for a hydrogen atom in the open chain or aliphatic compound. Increase of chlorine atoms increases boiling point, molecular weight, and specific gravity.

Stability is variable, and depends upon temperature, and contact with metals and other chemicals. Instability is most undesirable, as it may render the solution inefficient, or may even produce products harmful to materials or health of workmen. Light, heat, water, and certain metals may cause the breakdown. Stabilizers are therefore added to prevent it.

Contact with open flame produces phosgene which is a deadly poison. The characteristics of trichlorethylene in which we are interested are:

B. P.	189.1°F.
F. P.	—126.4°F.
Inflammability	None.
S. G.	1.46
Vapor density at B. P. and 760 mm	4.45

Hence the solvent can be placed in a tank having one, two, or more compartments, and safely heated. The vapors will rise, condense on cold objects suspended in them, dissolve the grease, and drip back into the tank. Vapors not condensed on the articles are too heavy to rise out of the tank, and sooner or later contact the sides. There is a cool belt surrounding the tank, the temperature of this area being kept down by running cold water, and this distilled liquid flows over a dam into the original compartment. Thus we see that the system provides a self distilling or renovating action. Any water which accidentally gets into the solution is trapped off by a device which operates on the basis of the difference in specific gravity of the two fluids. The apparatus may be a small one a yard in length for small parts dipped by hand, or it may be a huge device a hundred feet long through which parts are carried by conveyor, and cleaning is done by vapor or a combination of vapor and spray. Practically the same technique accompanied by the same potential hazards can be employed in the use of the several members of the methane, ethane, and ethylene groups.

Tetrachlorethane is very effective but is much more toxic if allowed to escape. Tetrachlorethylene is more closely related to trichlorethylene and is considered less toxic.

Dichlorethylene and ethylenedichloride differ both chemically and pharmacologically. The latter has a peculiar tendency to cause corneal opacities which may or may not be permanent. There have been few cases of death reported as due to either one. Dichlormethane and dichlorethylene are quite similar, both being, according to McNally, less toxic than carbon tetrachloride or trichlorethylene.

In formulating safe rules for the use of all these substances the most important principles are:

1. Selection of healthy, non-alcoholic employees.
2. Provision for a safe place of work. This requires adequate ventilation, proper tanks, conveyors, and constant maintenance.
3. Personal protection such as masks, etc.
4. Thorough knowledge of just what is being used, and the degree of danger to be anticipated.
5. Frequent examination of employees exposed.
6. Adequate instruction of workmen on the subject of hazards of uncontrolled exposure.

Thus cooperation between employees and management, as a result of knowledge of proper methods, will insure safety in handling all of the solvents in common use.

New Method for the Treatment of Industrial Backs

—Treatment of Low Back Pain with "Eucupin Oil" Injections: Preliminary Report of more than 100 Cases Treated from November, 1936, to November, 1937—

Fred Irwig, M.D.,
Medical Director,
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Kansas City, Missouri

As far back as 1934 I attempted to attack the low back pain problem by the injection of 5 cc. or more of 0.5% to 1% procain solution deep into the low back muscles.

The immediate results were mostly striking, but the pain free period was often too short.

In search of a preparation that would give the desired immediate and prolonged anesthetic effect, the local anesthetics in oily solution were considered. "Eucupin Oil" was suggested to us by Dr. M. M. Marks.

Since November, 1936, we have used the "Eucupin Oil" injection treatment routinely in all cases of acute or chronic low back pain. In more than 100 cases treated with "Eucupin Oil" no undesirable after-effects were observed.

The procedure causes very little discomfort and the immediate result seems almost miraculous. The patient who had to be helped on the table, and earlier had excruciating pains on motion, will step down from the table unaided and may be entirely free of pain. In most instances no more discomfort is felt on motion or bending, although a slight feeling of numbness may be present at the site of injection. Only very few cases had to be reinjected after a day or two, or, in one case, even

after one week, to achieve a final permanent cure.

INJECTION PROCEDURE: The sacro-iliac region is surgically sterilized with tincture of merthiolate. A 5-cc. syringe and a 21-gauge needle 1½ inches long are used for the treatment. While the patient is lying on the abdomen the injection is made into a low point of the angular space found by palpating the erector muscle between the medial dorsal crest and the ilium bone and the lowest part of the lumbar spine. The needle is pushed down vertically all the way and if, after aspiration, no blood follows, the largest amount of the oil is deposited into the deepest parts. While the needle is slowly withdrawn, a smaller remaining amount of the oil is gradually and continuously injected into the upper layers of the erector muscles. The injected area is then massaged forcefully. Usually 1½ to 2 cc., rarely more, "Eucupin Oil" are so injected into one or both sides of the back.

A series of 35 consecutive unselected painful back cases seen from November, 1936, to April, 1937, treated with "Eucupin Oil," were studied. These cases were compared with records of 35 consecutive back cases from the same plant treated before that time, and without "Eucupin Oil" injections. It was found that the disability period in the "Eucupin Oil" treated cases was reduced by 59%.

The topographical location of the injection-needle after it was placed in the tissues was demonstrated by roentgenograms.

The distribution of the "Eucupin Oil" in the tissues after the injection was learned through the use of a radiopaque oil. An iodized "Eucupin Oil" was produced and used for that purpose.

"Eucupin Oil" injections also proved to be very successful in the treatment of myositis and neuritis in various parts of the body other than the back. In cases of severe, chronic muscle spasms (torticollis) "Eucupin Oil" injections effected a cure.

Iodized "Eucupin Oil," primarily used for diagnostic purposes, apparently has even greater therapeutic possibilities than the plain "Eucupin Oil."

While the "Eucupin Oil" injection proved to be a valuable new therapeutic procedure, it should not be considered a cure-all for all cases of low back pain.

A careful, true history is most important in every case. The physical and x-ray examination should be thorough. Only after careful search for the cause of the back pain should the "Eucupin Oil" injection be used. If this routine is followed, the immediate relief obtained will not veil the presence of pathological conditions which may require other proper orthopedic procedures.

Conservative Treatment of Carpal Bone Injuries

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OUR results achieved with the non-operative conservative form of treatment, suggest this report of 10 cases of carpal bone injuries which have come to our attention during the past three years and emphasize the bones most commonly injured — the navicular (scaphoid) and lunate (semilunar). Conditions for studying these cases have been ideal, ie., frequent examination without inconvenience: ample x-ray studies without cost to the patient; observations of the work, and the accident which caused the injury.

The factors causing carpal bone injuries are well known. These bones are usually injured by direct or indirect violence. Fractures of the distal row of carpals and the pisiform are, as a rule, the result of direct violence, and the extent of the injury depends upon the severity of the violence. The navicular, lunate, and triquetrum (cuneiform) in that order of frequency, are most usually injured by indirect violence, such as sudden severe dorsiflexion caused by a fall on the outstretched hand, cranking an engine which suddenly backfires, or the kick of an electric wrench.

The navicular is by far the most commonly fractured carpal, probably because of its shape and the fact that it is the main buffer bone of the wrist and receives most of the force transmitted through it from the hand to the end of the radius which supports it on the proximal side. This fracture should thus be given special consideration.

The lunate, next in importance as a buffer bone, is supported by the medial edge of the radius, and the medial portion of the less resistant triangular fibro-cartilage, together with having the added support of the navicular and triquetrum on either side. Kienböck in 1910 described a degenerate condition of the lunate formerly believed to be wholy traumatic in origin, but it has been attributed to occupational strain and/or to bacterial infection. Most authors freely admit that the original injury may be so slight as to result in relatively little disability at the time, but after a variable period of quiescence may appear again with all the symptoms of an initial injury (see cases Nos. IX and X). A similar though much rarer condition of the navicular is known as Preiser's disease.

The triquetrum carries the least buffer action and may be fractured by indirect violence such as force transmitted from the hypothenar eminence, throwing the hand in ulnar deviation and dorsiflexion.

The initial signs and symptoms of carpal fractures caused by indirect violence are not usually severe, and are frequently misdiagnosed as sprains or strains. On inspection one may observe

the patient carrying his forearm with the hand held in rigid pronation, and with variable or even no swelling over the dorsum of the hand and wrist. Palpation of the wrist may elicit tenderness centered over the injured carpal, without deformity. On manipulation the patient complains of increased pain on dorsiflexion of the hand and the motion is usually limited. When the navicular is involved difficulty in abduction may be noticed, contrary to triquetrum injury which inhibits adduction of the hand. In Kienböck's disease of the lunate, as well as fractures of that bone, Finsterer's sign* may be present. Injuries by direct violence present signs and symptoms according to the severity and nature of the trauma.

When there is any suspicion of fractured carpals the diagnosis should always be confirmed immediately with x-ray because the prognosis by treatment with a conservative method is in inverse proportion to the time elapsing between the time of injury and the institution of treatment. Because of the odd shapes of some of the bones, fracture lines are often missed, especially those of the triquetrum which may be obscured by the pisiform in the antero-posterior view and, by the navicular, lunate, and head of the capitate in the lateral view. For this reason we feel the importance of obtaining an oblique view together with the usual antero-posterior and the lateral positions.

A thorough knowledge of the physiopathology of the navicular and the lunate is highly desirable, the facts of which have guided our treatment.

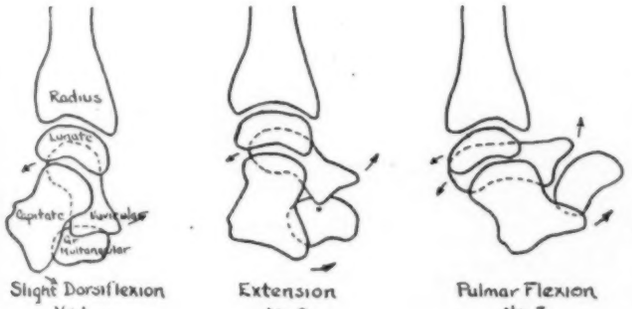

Fig. 1.

When the hand is in dorsiflexion (No. 1 in Fig. 1) the navicular is slightly inclined backward and upward, the lunate articulates with the center of the radial articular surface by its postero-superior surface, the capitate (os magnum) is inclined upward and its head articulates with the inferior part of the lunate and medially with the navicular.[4] The greater multangular (trapezium) which articulates with the metacarpal of the thumb also articulates with the distal portion of the navicular tuberosity. On increased abduction of the thumb or on pressure on the thenar eminence the greater multangular would be forced down causing greater pressure on the navicular accounting for pain in the wrist on abduction of the thumb.

On the extension of the hand (No. 2 in Fig. 1) the navicular assumes a more inclined position backward and upward, the lunate is horizontally placed and the capitate body is now almost perpendicular with the radius.

In palmar flexion (No. 3 in Fig. 1) the navicular head rotates backward and more closely assumes a horizontal position with the articulating surface of the radius. The lunate still articulates well with the radius and the capitate is now in full perpendicular articulation with the lunate.

Fig. 2.

It may be seen that if the dorsal ligaments were removed to expose the back of the lunate, and without interference with any of the other ligamentous structures, on dorsiflexion of the hand the lunate bone would be seen to be "crowded out" by its neighbors which are firmly attached to the strong lateral ligaments so that it tends to spring forward. After removal of the dorsal ligaments it can be dislocated by comparatively little force on the palmar surface of the hand. While the dorsal ligaments remain intact it is kept in position, and is subject to stress between the head of the capitate and the unequal counter pressure exercised on its proximal aspect by the triangular fibrocartilage and the more resistant medial articular facet together with the edge of the inferior surface of the radius.[5]

In considering treatment let us again emphasize the importance of early recognition of the injury. Those cases which are diagnosed as sprains or strains and weeks later x-rayed only to discover a fractured carpal often cause prolonged periods of pain and disability, followed by radical operations which may often be avoided. When the signs and symptoms or even the history is suggestive of possible carpal fracture x-ray examination should be imperative. The occasional negative plates obtained will be well compensated for by the discovery of a fracture, the potentialities of which were possibly minimized.

Immediately upon the discovery of a fracture, a plaster cast is applied for at least six weeks with the hope that primary union will occur. A shorter

* Finsterer's signs of fracture of the lunate: (1) Tenderness in the region of the lunate elicited by tapping on the knuckle of the third metacarpal bone of the closed fist. (2) Retraction of that knuckle—from vertical shortening of the lunate—in compression fracture.

period of time is felt to be entirely inadequate. This period of immobilization we feel to be necessary knowing that the navicular and triquetrum obtain their blood supply from their broad vascular lateral attachments, whereas the lunate lacks this advantage as well as being deprived of the regenerative power of periosteal tissue, being mostly covered by articular cartilage. This may be a factor in accounting for some of the deformation and degeneration occurring in Kienböck's disease.

When enclosing in plaster it is preferred that the hand be held in a position of rest, that is, slight dorsiflexion with a few degrees radial deviation and the fingers assuming slight flexion. This is done because, after the plaster is removed and the leather cuff applied, the hand is lowered to a position of extension with dorsiflexion limited to keep the hand within the range of comfort.

The plaster is applied to include the proximal phalanges of the fingers, and the thumb (in cases of navicular fracture) to the distal phalangeal joint, to more securely immobilize the hand, and to keep the greater multangular from pressing upon the navicular tuberosity on abduction of the thumb. In injuries to the lunate bone, plaster is applied with the hand in extension to avoid the "crowding out" of the lunate which occurs on dorsiflexion. If the initial cast is applied when the wrist or hand is swollen it may be necessary to remove the cast and reapply before the six or more weeks of rest is complete. After the plaster is removed hydrotherapy and massage are instituted daily and a leather cuff is applied.

Most authors suggest the use of a support of some kind following removal of plaster, but do not go into detail concerning just what to apply. We have a local shoemaker fashion a cuff to our design which is easily and inexpensively made. The dorsal half is made of stiff leather about 3/32 inch to ⅛ inch in thickness fashioned to extend from the metacarpal phalangeal joints of the fingers to about four inches proximal to styloid tip of the forearm. The volar half is made of soft leather with eyelets and tongue in place for lacing. The cuff is softened with water, applied to the wrist and allowed to dry assuming the anatomical shape of the wrist and hand (Fig. 2). In cases of scaphoid fracture where pain is experienced on hyperabduction of the thumb, the cuff is fashioned with the stiff leather limiting the abduction by encroaching upon the base of the thumb. This appliance will allow slight dorsiflexion, some radial and ulnar deviation and free use of the fingers. The cuff is worn continuously for the first few weeks and then only while at

TABLE I.
TEN CASES OF CARPAL BONE INJURIES

Case	Date of Accident	Date Seen by Physician	Injury	Cause	Initial Treatment	Secondary Treatment	X-Ray Result	Clinical Result	Remarks
I. P.McC. Age 29	2/6/35 1:30 A. M.	2/6/35 1:30 A. M.	Complete fracture through body of left navicular.	Fell on outstretched hand.	Plaster cast for eight weeks.	Hydrotherapy and massage for two weeks. Cuff for seven weeks.	Complete union in 6½ weeks.	Good	
II. C.E.H. Age 37	3/17/34 6:30 A. M.	3/17/34 6:35 A. M.	Complete fracture through body of left navicular.	Injured left hand between crankshaft and machine.	Plaster cast for eight weeks.	Hydrotherapy and massage daily for 12 weeks. Cuff for 12 weeks.	Complete union in eight weeks.	Fair	Treatment was complicated by ganglion.
III. O.C.D. Age 40	12/9/36 10:00 A. M.	12/9/36 10:05 A. M.	Complete fracture left navicular with wide separation.	Marked dorsiflexion of left hand.	Plaster cast for eight weeks.	Hydrotherapy and massage daily for five weeks. Cuff for eight weeks.	Non-union.	Good	
IV. W.M. Age 28	3/8/37 4:40 P. M.	3/8/37 4:50 P. M.	Transverse fracture of right navicular.	Fell on outstretched hand.	Plaster cast for five weeks.	Hydrotherapy and message daily for four weeks. Cuff for sixteen weeks.	Non-union.	Good	Cast removed five weeks contrary to advice.
V. S.B. Age 41	6/19/34 6:00 P. M.	6/19/34 6:05 P. M.	Transverse fracture of right navicular.	Twist of wrist dorsally and radially	Plaster cast for eight weeks.	Hydrotherapy and massage for two weeks. Still wearing cuff periodically.	Non-union.	Good	Re-injured on 9/27/34; brachial plexus injury 11/10/35.
VI. R.M. Age 29	8/3/37 4:25 P. M.	8/3/37 4:30 P. M.	Transverse fracture of left navicular.	Fell dorsiflexing his left hand.	Plaster cast for seven weeks.	Hydrotheraphy and message for two weeks. Cuff for four weeks.	Non-union.	Good	
VII. E.D.S. Age 24	8/23-37 10:00 A. M.	8/23/37 11:25 A. M.	Transverse fracture of left navicular.	Fell on outstretched hand.	Plaster cast for two weeks.	None.	Non-union.	Poor	Case left our care following day. Cast removed in two weeks contrary to instructions.
VIII. R.B. Age 37	10/27/37 10:50 P. M.	10/27/37 11:00 P. M.	Old ununited fracture of left navicular.	Fell on outstretched hand.	Hydrotherapy and massage six days. Cuff for three weeks.	None.	Non-union.	Good	
IX. W.H. Age 29	2/18/37 10:30 A. M.	2/18/37 10:35 A. M.	Kienbock's disease.	Fell, dorsiflexing right hand.	Hydrotherapy and massage two weeks. Cuff three months.	None.	Keinbock's disease	Good	
X. R.T. Age 31	11/9/37 6:30 P. M.	11/9/37 6:35 P. M.	Keinbock's disease.	Unusual strain on right wrist.	Hydrotherapy and massage ten days. Cuff while working.	None.	Kienbock's disease.	Good	

work. Gradually and slowly the patient is allowed to dispense more and more with its use until finally it is not worn at all. This latter event is left more or less to the discretion of the patient.

The cases presented in Table I lost only one and a half working days because of their injury. However, during the period in which the plaster was worn and also about the first week after the application of the cuff the patients were provided with work requiring the use of but one hand. Following this, they returned to their regular occupations.

Discussion

THE conservative treatment of the 10 cases by the method reported has demonstrated one poor, one fair, and eight good clinical results. There were two cases with complications: one (Case II.—C.E.H.) which obtained complete union roentgenologically but continued to have pain from a ganglion, confusing the diagnosis of the symptoms until the ganglionic fluid was withdrawn and local symptoms disappeared. The other case (Case V—S.B.) was complicated by reinjury to the wrist by marked dorsiflexion three months after the initial injury and a brachial plexus injury 17 months after his initial fracture. These complications in the later case prolonged the period of treatment, but the end result was clinically good. The one poor result demonstrates the inadequacy of shortened immobilization. The initial x-ray revealed the most satisfactory approximation of the fragments seen in any of the cases, and six weeks' immobilization should have brought complete union. Only one week of adequate fixation proved entirely unsatisfactory.

The navicular fractures were supported in plaster in moderate dorsiflexion except the one old un-united navicular (Case VIII—R.B.) the symptoms of which were relieved with the cuff alone.

The two cases of Kienböck's disease were relieved of local symptoms by the ordinary physiotherapy and the leather cuff.

A day and a half was lost from work because of these injuries (Case V—S.B. and Case II—C.E.H.) but one-handed jobs were provided during the immobilization in plaster and for an average of 10 days thereafter.

Conclusions

TEN cases presented to show success of conservative treatment.

2. Early recognition of carpal fractures is imperative to issue a favorable prognosis.

3. X-ray studies should include views in three planes, antero-posterior, lateral, and oblique.

4. Less than six weeks' immobilization in plaster is entirely inadequate.

5. The leather cuff materially shortens the period of disability.

6. The final result should be evaluated by clinical findings and not by the roentgenograms.

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The Treatment and Prevention of Industrial Neurosis

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NEUROSIS has been defined as a nervous disease, especially a functional nervous disease or one which is dependent upon no evident lesion. Psychoneurosis or hysteria has been used interchangeably in describing the condition. For the purpose of this discussion we are referring to a situation which is manifested by a wide range of varied symptoms of various degrees which are functional in character and have no demonstrable organic basis. Well defined psychosis and malingering (where one consciously with fraudulent intent simulates disease) are excluded.

The condition is not new. Our ancient predecessors, the alchemist, the soothsayer, the medicine man, depended upon a large following suffering from neurosis and probably obtained better results than we do today. In our national and economic growth at different periods certain factors have increased the number and emphasized the condition. Unwisely we have dignified the malady with a special name in each instance, *i.e.*, railroad spine, shell shock and now industrial or traumatic neurosis.[1]

What are the etiological factors that make neurosis a major problem in the medical care of men and women in industry? If the cause is known, the removal of the cause or an antidote spells prevention and may give a guide to treatment.

As a people we have not kept apace intellectually and emotionally with the rapid advances in our industrial life in this machine age, a product of our own inventiveness and irresistible force to push ahead. The noise and fatigue incidental to an industrial community have increased nervous irritability and emotional instability.[2] The complexity of the stern realities of being self support-

ing and gainfully employed has increased the desire for escape in many. So at the outset there are a greater number susceptible to this condition we call neurosis. The desire for escape is no different from the subconscious desire of the neurotic housewife with the burdens of a noisy household of young children; no different from the shell shock of the doughboy seeking escape from the noise and fatigue of trench warfare.

During the past few years the economic fluctuations and adjustments to our industrial growth have developed a sense of insecurity in many; in some an actual fear as to whether they could obtain the bare necessities of life. Opposing political and social groups have disseminated their divergent views with modern speed and dispatch often resulting in resentment and sometimes hate. This factor of resentment is no different from the resentment of the school girl with a conversion hysteria who had been taught to hate her teacher by ill chosen remarks of her parents. It is the same factor of resentment that was present in the shell shocked soldier who could not see why he should go to a foreign land to kill men he had never seen.

Most of our endeavors are tempered by a desire for reward; it may be monetary gain, the increased affection of a loved one, the improvement of our environment or the opportunity for more leisure. This desire, sometimes so pronounced we call it greed, admittedly influences our conscious actions and motives. Its influence upon the subconscious cannot be denied. In our social advancement to adjust to our industrial growth we have by our workmen's compensation laws held out a reward to those presenting a perverted emotional response to injury in their subconscious attempt to escape and often a subconscious attempt to get even and to satisfy that dormant resentment. True, the purpose of this legislation was not to afford a refuge for the emotionally unstable or to provide an inequitable pension plan, but there is a tendency for it to become just that. Aside from workmen's compensation the various sick benefit plans to provide funds during enforced idleness, again practical and economically and socially sound in their primary purpose, unless carefully planned and administered hold out a reward to the mentally ill and will swell the number afflicted with this condition we call neurosis.

Fear[3] which plays such an important part has been used as a tool by various agencies. In industry itself fear psycholology has been used to sell a safety program or to impress the necessity for prompt first aid. The intricacies of our body mechanisms and the ravages of disease have been the vehicle to advertise and sell nationally known products. Our own profession has fostered the education of the public in the vivid details of our body functions and the signs and symptoms of this and that disease. Individually physicians have been guilty of exaggerating the fear emotion in order to make their services appreciated by the patient. How often have we heard the patient or his relatives relate that it was the worst case Dr. Blank had ever operated and if it had gone another hour or day it would have been too late.

The problem of the prevention and treatment of neurosis must be the problem of every physician irrespective of his specialty. It is impossible for the psychiatrist or neurologist to see every patient in industry. I do not mean to depreciate in any way the value and importance of consultation with a psychiatrist or neuro-surgeon when the injury or ailment falls definitely within his field. The first attending physician irrespective of his specialty is one who may effectively prevent neurosis and upon him the responsibility must be placed.

IN REVIEWING the causative factors as noted, it is obvious that some of the preventive measures are outside of our direct control. The incidence of neurosis in the given plant may be materially decreased by careful selection of employees. By this I mean the exclusion of those presenting definite psycho-neurotic tendencies. I cannot see that extensive psychological or psychiatric studies on applicants for employment generally are of practical value. Care should be taken in job placement of the employee and a practical common sense evaluation of the individual's capabilities is sufficient. It would be impossible for us to employ only those with marked emotional stability and a high reserve of mental stamina. To go to the extreme suggested by some in the psychological analysis of applicants would deprive many worthy and useful individuals of employment. It seems to me that the correct solution as regards predisposition to neurosis in an industrial personnel is the maintenance of an employment environment which to the average individual would not predispose to neurosis. A study of the job is often more productive of results than a study of the individual doing the job. Jobs can be changed and improved easier than we can change the personality of the individual.

Obviously part of our problem is a pure engineering problem in producing more desirable working conditions. It is encouraging to see the efforts that are being made at the present time to decrease the noise and to provide good light and air to the man or woman in industry. Farsighted employers are studying carefully the relationship of fatigue to efficient output. The proper readjustment of hours and appropriately assigned rest periods can solve the problem. We must not lose sight of the fact that this exposure to noise and fatigue which influences so much our nervous irritability and emotional instability may be much more pronounced outside of the plant than within. We will again see the engineers materially aid in the solution of this health problem as they have done in practically eradicating water-borne diseases by modern sanitary engineering.

The more desirable the working conditions the less the desire to escape and the less enticing will be the compensation pay for not working. This reward offered under our compensation laws cannot be ignored as a very important factor in the production and continuance of neurosis. The experience in certain Scottish regiments of the World War, where shell shock was not recognized as an entity, reducing the number to practically

zero, is significant. It is common knowledge that in litigation cases the majority of the neuroses cases become symptom free once the settlement is made. The often repeated recommendation in the neurologist's report, "it would appear that the way will be open for a complete recovery if the case be adjudicated and closed," should be a guide to our law making bodies as to the correction of this social hazard in our compensation laws. If compensation is to be awarded for neurosis, a fixed and limited amount which can be promptly settled would decrease the number subconsciously seeking support and escape by this means. Again, should the case suffering an injury of no consequence and symptom free for a variable period of from six months to three years, and who then develops symptoms when his case is litigated or when unrelated mental stress or strain develops due to economic or domestic problems, be considered as coming under the purpose of the workmen's compensation laws? The neurologist tells us that the elements of the neurosis, the vivid details of the accident lie dormant and later manifest themselves in these functional symptoms and can be called a traumatic neurosis. May not the reward anticipated in the litigation or the new unrelated emotional trauma be responsible and the proximate cause of the perverted emotional manifestations? I think the reasonable man would so conclude.

ONE element in the production of neurosis is practically entirely within the control of the physician. This is the element of fear and the sense of insecurity as to the true nature of the injury and the eventual outcome which is present in a greater or less degree in every individual experiencing an accident. We should have thorough understanding of the normal emotional response experienced by the injured. This fear which I mention is a natural emotion and a normal physiological protective mechanism. It is greatest immediately after the accident or during the first few hours after the accident. Normally this fear lessens and gradually disappears and is no longer a problem when the case is properly managed and treated. This fear curve often follows directly with the pain curve. There is another normal curve which may be charted on the hypothetical average case. We will call it the extent of physical damage curve. Actually the point on this curve is highest immediately after the accident. True, it may be increased by improper first aid handling of the patient, but normally this physical damage curve should gradually fall to normal where a perfect physical result is obtained. In those cases where the perfect result is not obtained it reaches that level determined by the extent of the permanent disability following the injury. These two curves represent normal psychological processes. It is our problem to keep these curves plotted on their normal course. As already suggested we may vary the physical damage curve by improper treatment, neglect of treatment, or failure to diagnose the true extent of the injury. Our treatment should follow and should plot the same course as the fear and physical damage curves if we are to avoid additional mental trauma to an individual already disturbed emotionally. In short, the maximum surgical and related care which the injured should receive should be in the first 24 hours following the injury and gradually diminish as the patient improves.

Our whole plan must be directed in preventing new and additional emotional trauma. With modern surgery it should be possible never to permit the patient to experience severe pain after the first 24 hours. How often have we seen back injuries who were incapacitated due to a broken leg in which excellent results were obtained and we have no problem of neurosis as regards the back. How often have we seen severe head injuries that were incapacitated due to injury to some other part of the body and the problems of headaches and dizziness were not present in the after care. It is important that we do not permit localized and continued pain to form the basis for fixation of the neurotic complaints. We must prevent doubt and insecurity as to outcome as a result of delayed diagnosis and delayed treatment. The man who gives such a history of falling that an injury to the back may be suspected even by his fellow workmen is not disturbed by the ambulance, the x-ray, the hospital bed, maybe a cast and later a brace when this chain of events begin on the day of the accident when they are normally expected. But this same man who has been permitted to walk about, have his back strapped, physiotherapy, and then x-ray, hospital bed, etc., does receive new and abnormal mental trauma, new fears, new doubts, a new sense of insecurity, which may well display themselves by a perverted emotional manifestation six months or a year later when we attempt to have the patient resume some form of employment. The maximum treatment for the injury suspected should be started as a normal sequence immediately after the accident. In traumatic work a detailed and vivid description of the accident is absolutely necessary if our patient is to follow this normal sequence of events. Our judgment as to disposition immediately after the accident is based almost entirely on the nature of the accident and the injuries the patient probably received, rather than the actual physical injuries we are able to note at the scene of the accident. This is particularly true of knee, ankle and back injuries. Immediately after the accident the part may appear entirely normal and in fact display complete function but within 24 hours the patient be entirely incapacitated due to pain and swelling.

The patient's immediate and industrial family should be prevented as much as possible from interfering with the management of the patient. We are dealing with an individual who knows that by law he is provided with medical care at no cost to himself and who is living in an age when knowledge and facts regarding his body and different injuries and diseases are readily available to him and who knows that he will be compensated while he is ill and compensated for any permanent damage resulting from the injury. Accordingly to such an individual we should not spare any diagnostic measure and an honest straightforward

attitude in explaining to the patient the nature of his injury and the outcome may best come from the attending physician rather than first come to the patient at his compensation hearing where he listens to the details of his injury discussed pro and con. The attending physician knows best as to what period in the treatment to advise the patient the nature and extent of any permanent disability which will be present in those cases where such is inevitable. A careful physician may do this without adding additional emotional trauma.

By a carefully taken history and gaining the confidence of the patient we should learn as much about the emotional status of the individual as possible. Each patient represents an individual type and our treatment plan must be adjusted to that particular individual. Hospitalization would be wise for one man but wrong for the next, even though the injury be identical.

As much care should be taken in not over treating as in giving the required treatment on the day of the accident. Prolonged idleness is an emotional hazard to any of us. As soon as possible the injured should become occupied and the best place is at the plant. An occupied mind doesn't have time for fears and doubts. The judgment as to when the patient may return to work, and to how much work, must be applied to that particular individual. Months of careful management of the mental aspect of the injured may be lost if he is directed back to work too soon; experiences new pain, has to stop, becomes depressed and discouraged and gets the fixed idea he can never work again. The opportunity for the injured gradually to resume his duties by lighter work in the beginning is an invaluable aid to the industrial surgeon.

Making certain that compensation questions are promptly clarified to the individual by the proper parties counteracts the sense of economic insecurity. When the patient is discharged from treatment and a permanent defect is present the nature and effect on function should be carefully explained to the patient. We as physicians can diminish some of the reward factor by having our history and proof of extent of injury so complete and accurate that controversies at the compensation hearings are reduced to a minimum. Also if we guard against fantastic excursions into the realm of questionable and unproved scientific possibilities as to cause and effect and confine ourselves to the question, so aptly stated by Moorhead[4]: "What usually and ordinarily happens under the same circumstances?" we may help to prevent the spectacle of the mentally ill going to one hearing after another, listening to doctors and lawyers expound their divergent views as to his physical condition.

As the majority of the neurosis in industry is seen in those experiencing trauma my remarks have been mainly concerned with that group. From the doctor's standpoint our solution is in prevention. As to treatment of the established neurosis following compensable injury I can only cite to you again the closing recommendation on the neurologist's report: "Complete cure should follow a lump sum settlement." This not only signifies our helplessness but points to the real cure.

Time does not permit discussion of the other neuroses seen in industry. In comparison the latter are easy to prevent and much can be accomplished in treatment. A thorough understanding of the individual, good medicine and common sense permit us to correct or divert their perverted emotional response to their problems arising in their work and outside of their work.

In conclusion I feel I have told you little, told you nothing new. At most I have emphasized new factors in the production of a long recognized malady. We have the same emotions in the patient with the same perverted symptomatic responses, but a patient in a new environment with old factors in a new form as the cause. As physicians we must meet this new situation and make prophylactic mental hygiene a part of the armamentarium of our chosen specialty.

Paradoxically, our diagnosis and treatment must be the most exacting medical science permits, yet at no time has the art of the practice of medicine been so necessary. We must be masters of our medical science and not medical science masters of us.

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Medicine—the Guide and Measure of Safety

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SINCE I entered the ranks of industrial medicine I have consistently avoided the so-called "industrial picture." I have done this in all sincerity in order to retain the perspective of an outside physician. After three years of gazing from this vantage point, a few broad conclusions have been drawn.

Perhaps because of shortsightedness, medicine was harnessed upon industry by legal enactments. Directed primarily toward repairing the mistakes of human engineering, it was in the main a part-time, contract, or insurance profession. The practice was chiefly surgical. Under these conditions, the measure of this imposed and yet necessary

nuisance was by the rod of cost, and safety likewise was measured with the same stick. Conditions have changed; the yardstick remains. The increasing variety of services expected of and properly assigned to an industrial medical department has gone far beyond the mere care of injury and is pointing steadily toward administering all phases of preventive medicine and public health. Safety engineering has advanced the mechanical safeguard toward a waning necessity for the full-time industrial surgeon. No longer is a vast experience in traumatic surgery to be had within our industries. That experience is now in the general accident wards and the subjects are furnished by our streets and highways, and the private pursuits of our citizens.

I have reached the positive conviction that 85% of industrial medical service and cost is bestowed upon 30% of the workers. Sixty per cent of our industrial family is composed of good, average American citizens, requiring the remaining 15% of cost and service. Ten per cent are sufficiently above average to require no service at all. This 70% constitutes the very backbone of industry and the future welfare of the nation. Within this group lie the important collective problems and their solutions.

An overwhelming percentage of the headaches to labor relations and personnel departments are to be found within the 30%. It is here that we find the majority of radicals, indigents, neurotics, and otherwise below-par brothers. One required to expend the major portion of his time and effort upon this minor group is apt to lose his broader view of humanity. He is prone to accept it as the criterion of all labor. Here springs the oft-repeated phrase, "records adequate for legal defense"—an indication of a loss of faith in our fellowmen. Too much attention is paid to the occasional thief, miscarriage of justice, or renegade politician. For every employee who has put a shady deal over on his employer there are 200 who could have done likewise, but their inherent honesty forbade. Keeping this latter side before you will give much comfort and retain faith in the major portion of humanity. All too frequently the ills generated by such a minority become a major problem, because the everyday ailment, education, and care of the dependable majority have become obscured and neglected. A barrage of articles and addresses upon industrial workers and conditions, by authors ranging from the lowliest social worker and reporter to university professors, is inflicted upon the public. They bear upon injury, disease, psychology, neurology, the shortened life span of the industrial worker, and a host of other such subjects. There is merit and some truth in a few of them, but the majority call to my memory the definition of history ascribed by one of my beloved instructors of prep school days. "History," said he, "is something that never happened, told about by someone who wasn't there." The full-time industrial physician *is* there, living with his patient the day through, and it is from this source the true history will come if only he will seek it.

That a mere handful of physicians safeguard the well-being of a quarter-million of our fellows during their earning hours entails grave responsibilities and obligations. Our patient is the life line of a million souls. That these quarter-million are

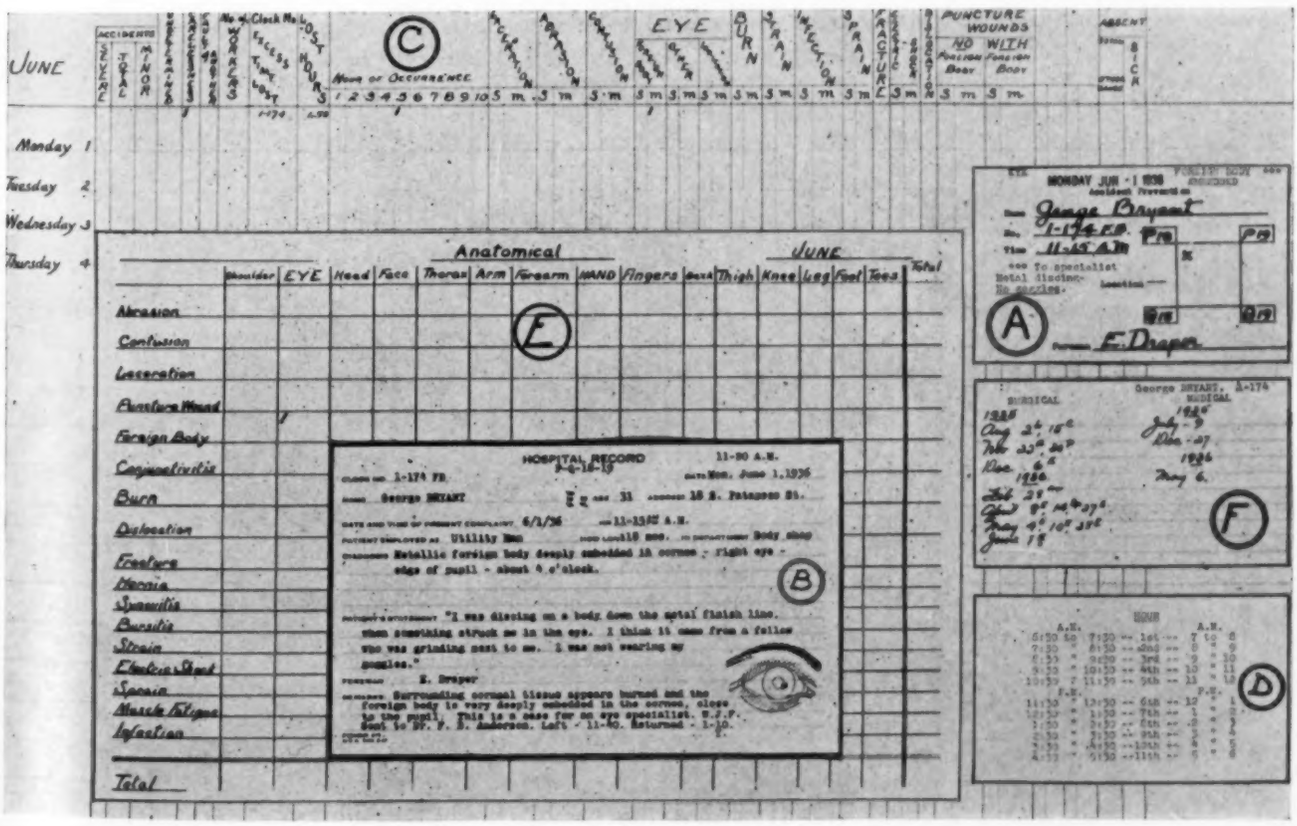

Fig. 1. The Six Forms having to do with the Treatment, Course, and Recording of an Injury

divided into approximately 80-odd clinics, with a wide geographic distribution, presents wonderful opportunity for service and study of individual and collective humanity. In no other branch of our profession, excepting perhaps those of our number engaged in public health, is the opportunity given to such a few to serve so many.

As each day passes it becomes increasingly obvious that the material and human factors combining to form an industry in their aggregate present one individual. Its histologic cells are human beings; its anatomy, planned buildings and whirling mechanism; and other metaphors represent the various basic studies of the human body. It is likewise manifest that there is an extensive — what we may call "collective pathology," both macro- and microscopic, the symptoms of which run from accidents to unsound thought and actions. There is much unexplored territory in this land of collective pathology. Ours is the opportunity, and much treasure in etiology and cure lies buried there.

Only in the few schools of hygiene and public health is there to be found educational equipment with which to study the collective problems. Medical school curriculums offer little. This adjunct to the education of medical students who consider entering our field is imperative. The average medical man, should he enter industry, will gain knowledge of these problems only by experience, and experience teaches slowly and at the cost of mistakes. Should the doctor's time be occupied entirely with our previously mentioned 30%, he will gain neither experience nor knowledge.

We must never lose sight of the values, rights, and dignities of the obscurest individual; however, to understand man we must look beyond the individual man and his actions and interests, and view him in combination with his fellows. To view him in combination with his work we must know something of that work. It is, therefore, essential that we educate ourselves in the geography and anatomy of the factory and in all phases of its activities; from management to janitor, comptroller, time keeping, plant layout, time study, cost control, maintenance, personnel direction, and a host of other phases. It is far-sighted management that renders this education available to the plant physician. When we communicate our observations to industrial leaders, let us also, to promote understanding, couch our language in their terms and give them things that they can clearly see.

DR. H. M. VERNON, in a chapter upon the "Economics of Fatigue and Unrest," made this observation: "There are many various safety campaigns and many subtle schemes advanced for the promotion of safety. Yet there seems to be no definite scientific method of actually measuring the improvement in efficiency, nor if that improvement is noticed, is there a method of measure which can attribute it to this or that definite factor." I believe that this is so because few observers master their collective patient in its entirety. Little could be learned concerning typhoid fever beyond the bacteriological by gazing at the bacillus typhosus through a microscope, nor about plumbism by making endless basophilic aggregation analyses.

Nothing new is being expounded here; in fact, this is a deliberate revival of the past. In this modern neurotic scramble to find the new, the rare, the sensational, our hasty hunters neglect the thorough and ignore the firm foundation. The youthful modern attempts to interpret Mozart without first mastering five-finger exercises; the third-year medical student specializes and attempts to master the auscultation of a mitral regurgitation before listening to more than 20 normal hearts. The eye grasps at the microscopic before the gross, and the pseudo-genius invents before knowing the elements of physics.

Only by patient dragging of the entire bottom can the hazards of the ocean's floor be known and a safe and steady course be charted. This must be repeated again and again, because even these things change. Our course may well be charted by oft-repeated sound principles — the advice of a great medical teacher to his pupils may well be repeated here: "Observe, record, tabulate, communicate. Use your five senses. See—and then reason and compare and control. But see first. When you have seen, read. And when you can, read the original description of the masters who, with crude methods of study, saw so clearly. Re-

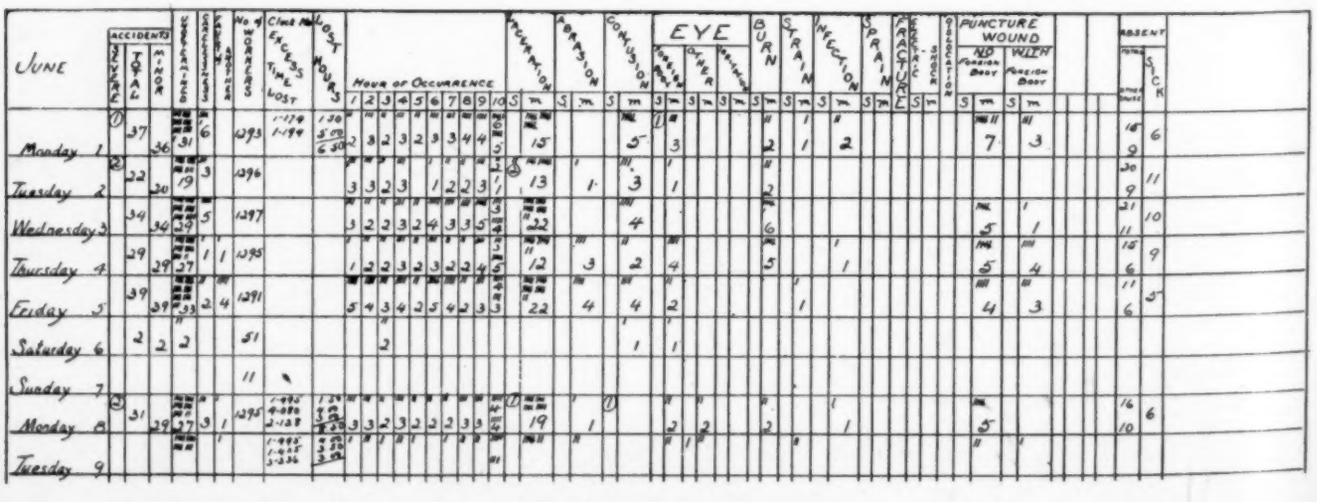

Fig. 2. The Daily Totals

cord, make a note at the time, do not wait. Viewed through the perspective of memory an unrecorded observation, the vital details long since lost, easily changes its countenance and sinks obediently into the frame fashioned by the fancy of the moment. Always note the unusual. Keep and compare your observations. Do not waste your time in compilation, but when your observations are sufficient, do not let them die with you. Study them, tabulate them, seek the points of contact that may reveal the underlying law. Some things can be learned only by statistical comparison. If you have the good fortune to command a large clinic, remember that one of your chief duties is the tabulation and analysis of the carefully recorded experience. He who works in his own small compartment leads a restricted and circumscribed life. Go out among your fellows and learn from them. Interest yourself in local conditions and undertake the responsibilities of citizenship." [Osler.]

It is through the application of these sound principles that we will best advance our knowledge and service to our collective patient and to humanity in general. Let us apply these principles toward proving that medicine is both the guide and measure of safety.

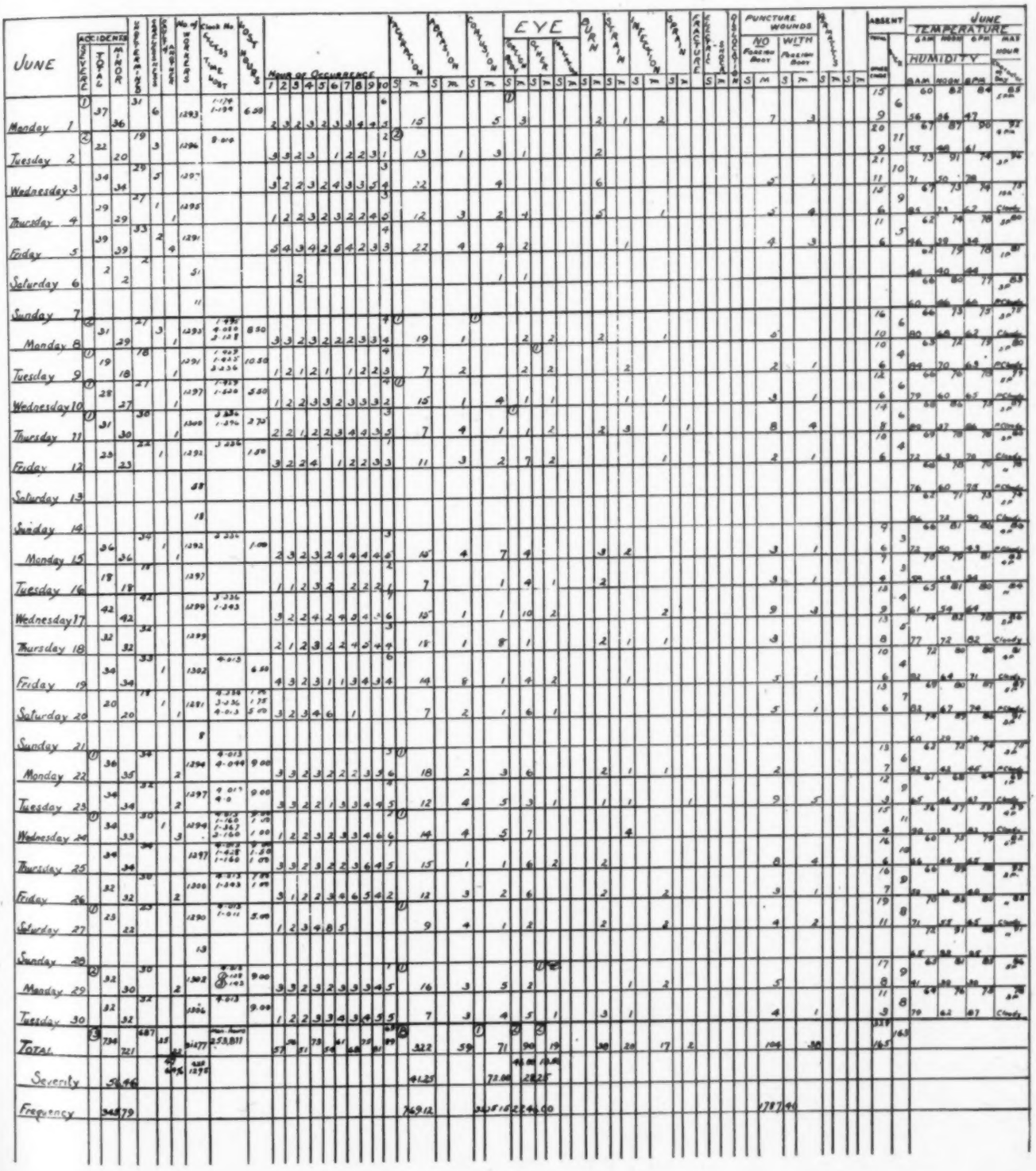

Fig. 3. The Permanent Record

WHAT we have to say here deals specifically with accidental physical injury, but bear in mind that such studies are likewise applicable to all phases of industrial hygiene and sanitation.

The first figure (Fig. 1, p. 501) presents the six forms (lettered "A" to "D") that have to do with the treatment, course, and recording of an injury. An injured man enters the dispensary. He brings with him Slip A (Accident Prevention), furnished by the foreman. On it are noted the name, number, time of the accident, and an "X" to indicate the spot where the injury occurred. The dispensary personnel adds the following data: In the left upper corner, the anatomy—face, eye, leg, etc.; in the right corner, the type of injury—laceration, burn, fracture, etc.; and across the top, the date. The slips are sorted as to type of injury and filed by date, the most recent being kept forward. We will refer to them later.

Form B is the complete case history, from admission to discharge.

Form C has been prepared to receive the data as indicated in the column headings. Form E is for the recording of the anatomical distribution of injury. Let us record this case. The time of the accident was 11:15 A.M. The patient had begun work at 7:00 A.M. A glance down the table represented in Form D places the accident in the fifth hour. It is thus marked. It is an eye injury, with a foreign body, and is marked in that column. The patient states that he "was not wearing goggles" on an operation and in a zone where it is mandatory. A mark is made under the column headed "Carelessness." He was sent to a specialist, losing one and a half hours in excess of the average minor injury. His clock number and the lost time are noted in that column. We record all lost time in excess of average. On Form E we make a mark in the "Eye" column opposite "Foreign Body." Form F is the "Detail Card." One column is for medical and the other for surgical service. Each new visit is denoted by the date, and a small symbol indicates the type of injury. Time study determines one minute and 10 seconds to be sufficient for this entire operation. The properly trained clerk will note an abnormal number of recent eye injuries and it will be called to the attention of the plant physician. The judicious application of personnel direction through supervisor and foreman down to the individual makes this form of medical cooperation extremely valuable. By frequent reviews of this file, and by adding symbolic guide tabs, the individuals automatically classify themselves. This is the source of the positive conviction relating to that 30 and 70%. Comparing these records with personnel and employment histories gives ample evidence as to the source of the "headaches." Here is the foundation for educating and reclaiming the individual, for minimizing injuries, and for extending a helping hand to many of our unstable, languid, pillar-to-post brothers. We leave to your imagination the potential benefits to be derived.

At the end of the day the marks are totalled and we have Fig. 2. (See p. 502.) So far all is done with pencil. Sufficient time is given for correction;

1937	Accidents: Fatal	Accidents: Total	Accidents: Minor	Unclassified	Cases Admitted	Cases Returned	No. of Workers	Man Hours	Hours Lost	Hour of Occurrence (1 2 3 4 5 6 7 8 9 10)	Laceration S	Laceration m	Abrasion S	Abrasion m	Contusion S	Contusion m	Eye: Foreign Body S	Eye: Foreign Body m	Eye: Other S	Eye: Other m	Eye: Infection S	Eye: Infection m	Burn S	Burn m	Strain S	Strain m	Infection S	Infection m	Sprain S	Sprain m	Fracture S	Fracture m	Electric Shock	Puncture Wounds: No Foreign Body S	Puncture Wounds: No Foreign Body m	Puncture Wounds: With Foreign Body S	Puncture Wounds: With Foreign Body m	Burns S	Burns m	Poisoning S	Poisoning m	Amputation S	Amputation m	Other Cases	Absent: Total	Absent: Sick	Indexes: Severity	Indexes: Frequency	Indexes: Excess Hours Lost
January	6	634	628	481	106	7	33824	305334	57		2	298		79		94	1	78		32				30		18		12		4	1				76		33							1079	658	1090	467.9	
																																										421				
February	5	840	835	340	74	5	27171	149317	11			162		41		34	1	34		24				12		5		4		2					31		9							104	35	640	466.7	12292
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March	10	1332	1322	779	344	14	57390	471085	39		3	502	1	113	1	117	1	138	1	49				50	1	22	2	12		2		2	1		138		56		2					882	540	1132	417.0	12072
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April	11	1097	1086	639	135	42	54240	444786	390		3	446		85		128	1	112	1	44				52		33		21		7					154		81							698	395	997	406.3	1193
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May	3	998	995	694	134	31	47776	402235	133		3	398		120		101		125		51				43		12		9		4					131		63		1					629	398	3310	405.6	3030
																																										231				
June	2	770	768	708	147	15	35523	298544	5			359		82	1	80		66		31				43		9		7		1					84		33							464	209	3830	388.6	29469
																																										255				
July	9	1184	1175	705	630	30	50369	421777	221		5	511		131		108	1	132	2	34				78	1	28	1	15		1					129		55	1	1					699	816	1313	356.2	1909
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August	9	1295	1286	939	301	26	54263	433345	40		3	524		142	1	121		143		68				94	2	6		27				8			128	1	36							739	274	1398	344.2	10834
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September	13	601	588	493	95	21	38737	243326	1854		1	206		85		71		87		38				41		3		4		1					57		36									462	404.8	131
October	2	887	885	590	240	29	44433	366413	13		2	388		103		85		118		43				42		9		11							89		30							450	186	4435	413.0	28186
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November	7	876	869	487	187	25	42012	370212	184		3	346	1	84	1	118		113		43				31		8		10		2		2			131		70							934	190	1231	422.6	2012
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December	3	559	556	318	238	9	30146	224212	38			248		60		75		68		32				24		6		3		2		1			66		39							224	112	1868	401.0	5909
																																										112				
Total	90	9332	9242	6404	2838	293	593581	4734832	2983		29	3988	1	1123	10	1132	4	1228	4	488	1	1	3	398	3	133	3	183	1	28	1	1	1	1	1314	3	541	4	2					8908	3435	12915		
Year 1937			8452		2810																																					8930			400.2	1385

Fig. 4. The Yearly Record

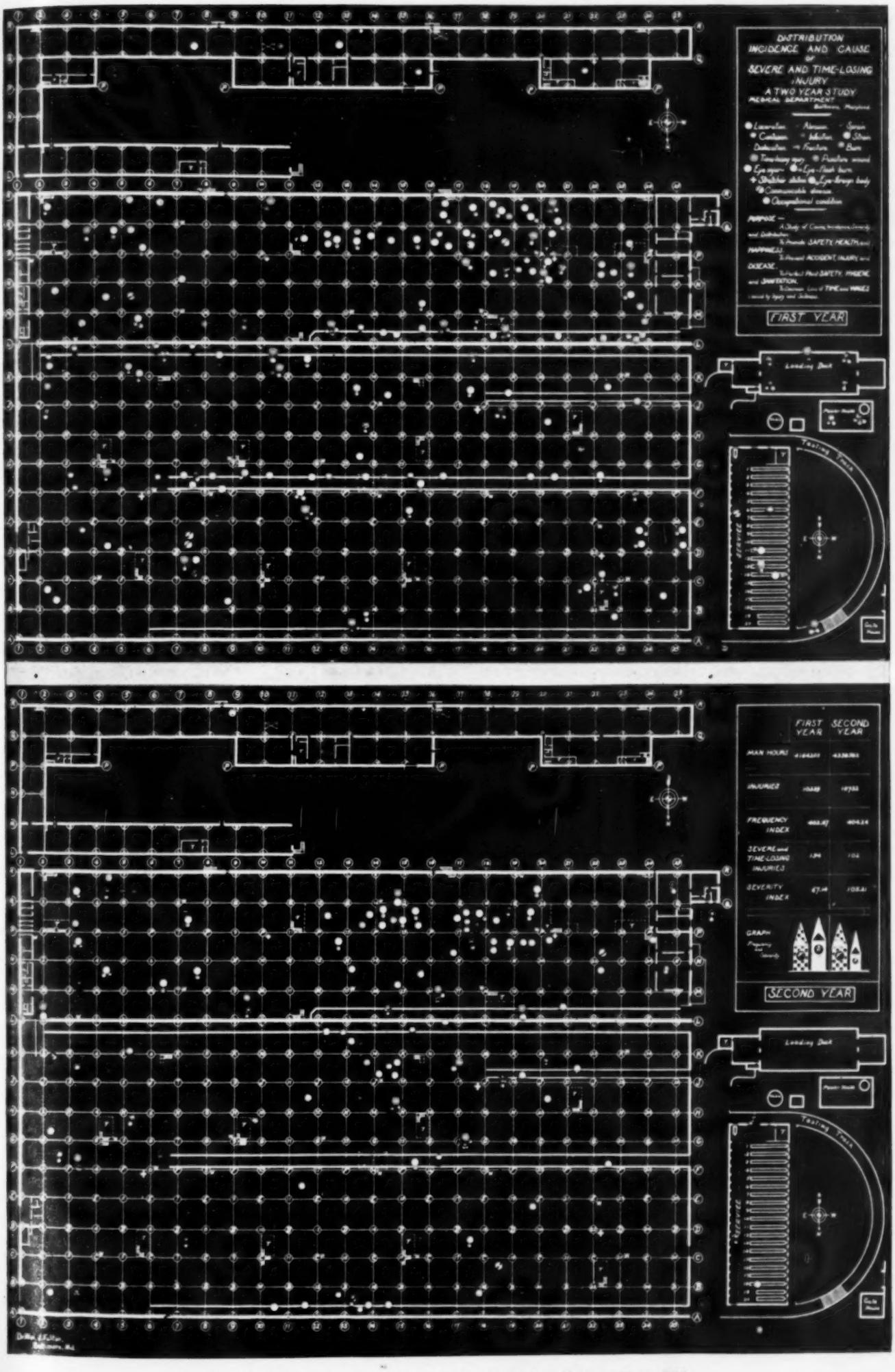


Fig. 5. The Two-Year Picture of the Map described on Page 506

for instance, a minor laceration may have developed an infection, changing it to severe. The material is then transferred to the permanent form, Fig. 3. (See p. 503.)

Furnishing the medical department with varied information has become routine. The number of men working, man hours, costs, absentees, transfers, hires and fires, safety equipment, and other items are furnished daily. From the Weather Bureau come our humidity and temperature reports. All is scrupulously recorded. There may be a relation between these things. If we fail to find it, at least we leave these hunting grounds to others of our earnest scientific brothers who are searching for truth. Here, day by day, is the bedside chart of our collective patient; here lies the "flow chart" of human material, the maintenance of the human tools, the barometer of injury, the guide to safety, and the hidden answer to many unsolved problems.

At the end of a year, and years to come, we have Fig. 4. (See p. 504.)

While all these data were accumulating, we concentrated on severe injuries. Each was swiftly followed up, a thorough report made and placed before manager and personnel director. A map was drawn, placed on the wall, and the injured workers represented by colored tacks. Warnings were issued that severe injury was likely to occur in this or that zone because of certain of our observations. Little attention was paid this at first. Then things began to happen, and some of the warnings materialized into severely injured men. These reports have reached the point where the rapidity of action on the part of management is a tribute to them. Severity has dropped. We now enjoy the cooperation of an enthusiastic supervision. Potential accidents are quietly eliminated. The two-year picture of that map is here presented, Fig. 5. (See p. 505.) That the apparent reduction is real is obvious when we consider that there were 175,000 more man hours worked in the second than in the first year.

An industry cannot be expected to support a gathering of aimless statistics. We believe these records have value. Only a few examples can be given.

In Fig. 6 we have a record of the hours of occurrence for three separate months. The total for each month is shown on the bottom line. A cursory glance reveals nothing but a mass of similar figures. One living with these figures notes quickly the change from the usual. There

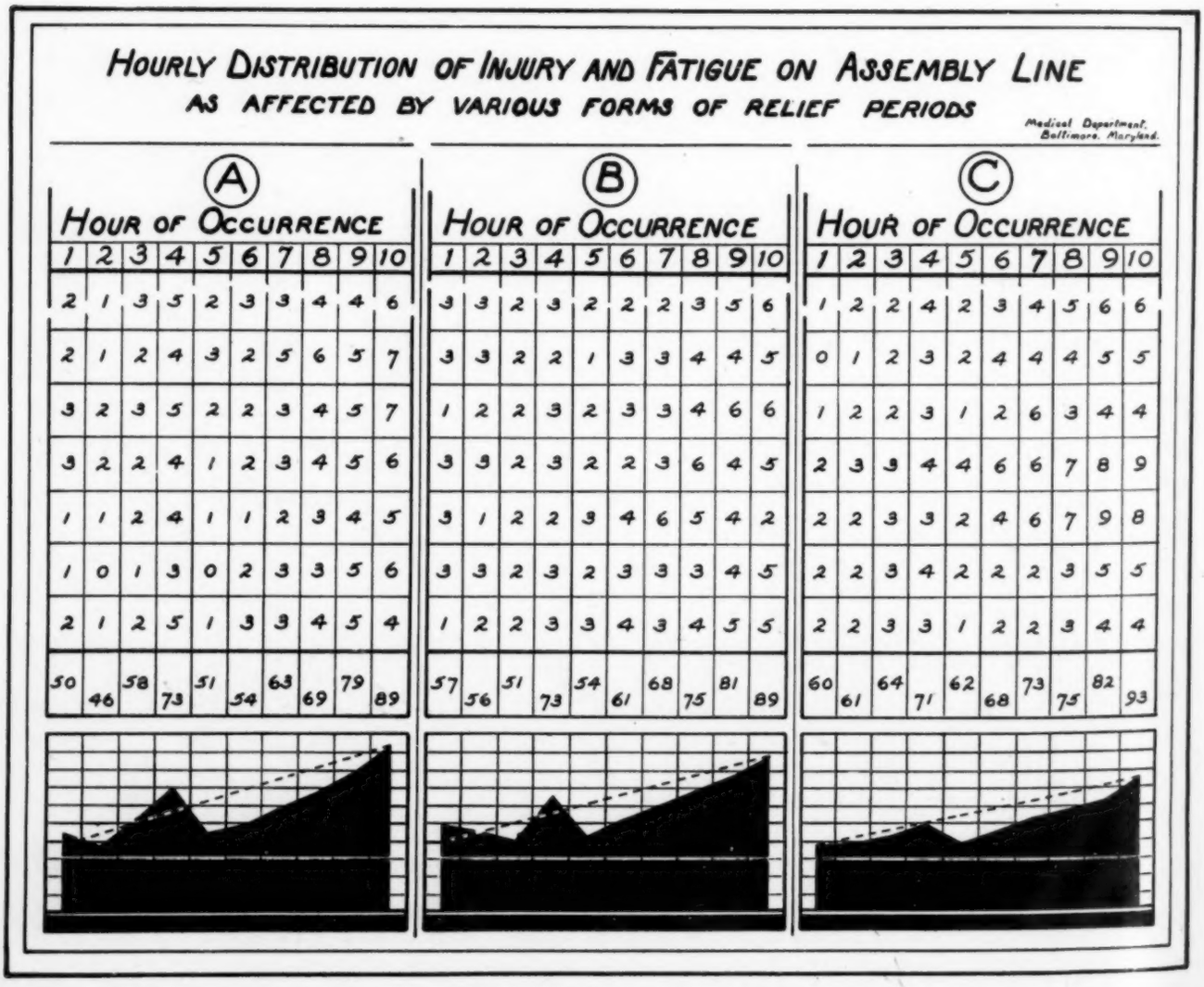


Fig. 6. Hours of Occurrence

are marked differences here—the graph demonstrates them. "A" is the usual; the syndrome of fatigue is apparent, the drop in the fifth hour occasioned by the usual lunch period. In "B" the plant was shut down for a 12-minute rest period between the second and third hours. In "C" sufficient utility and relief men insured to every employee a six-minute rest period in the pre-lunch and after-lunch hours. There was no plant shut-down. It was proved that the change in these curves was due to these alterations in rest periods and the additional relief men. The change in the volume of our graph is plain; the change in the pitch (dotted line) cannot be missed. A partial cure for fatigue finds itself. We venture the statement that there is a reflection in dollars and cents on the black side of that portion of the comptroller's ledger dealing with repairs, etc. This demonstrates that the bedside chart of our collective patient is sensitive to many things, and that cause and effect can often be traced to numbers of different factors.

Of what practical value is the keeping of a record of the anatomical distribution of injury? (Fig. 7.) A 16-month record of foot and toe injuries is presented. This is plotted and represented by our (black) graph. A safety shoe campaign was put on in September and was pushed more vigorously and consistently by Plant 1—as denoted by the number of safety shoes sold. Plant 1 drops and continues to stay well below the former level. There is very little change in Plant 2. We thus measure a safety campaign and determine its value.

NOW for a word about the measure of safety. I wish to go on record and would support a resolution that the medical profession refrain from taking part in any safety contest.

Safety standing should be based on all accidents, not simply on one class such as "time-losing." The cost of lost time injury and of critical illness is not one drop in the bucket of the cost of minor injury and illness. It may not show in the ledger, but it is there just the same. Take away the compensation unjustly filched, and the "drop" shows astounding shrinkage. Safety can best be measured by medical records, for they are or should be, especially in collective study, all inclusive. We should agree on a measure of severity and apply it conscientiously. It is best that severity be based on a minimum in order that a fair degree of comparison may be made between various industries. Of course

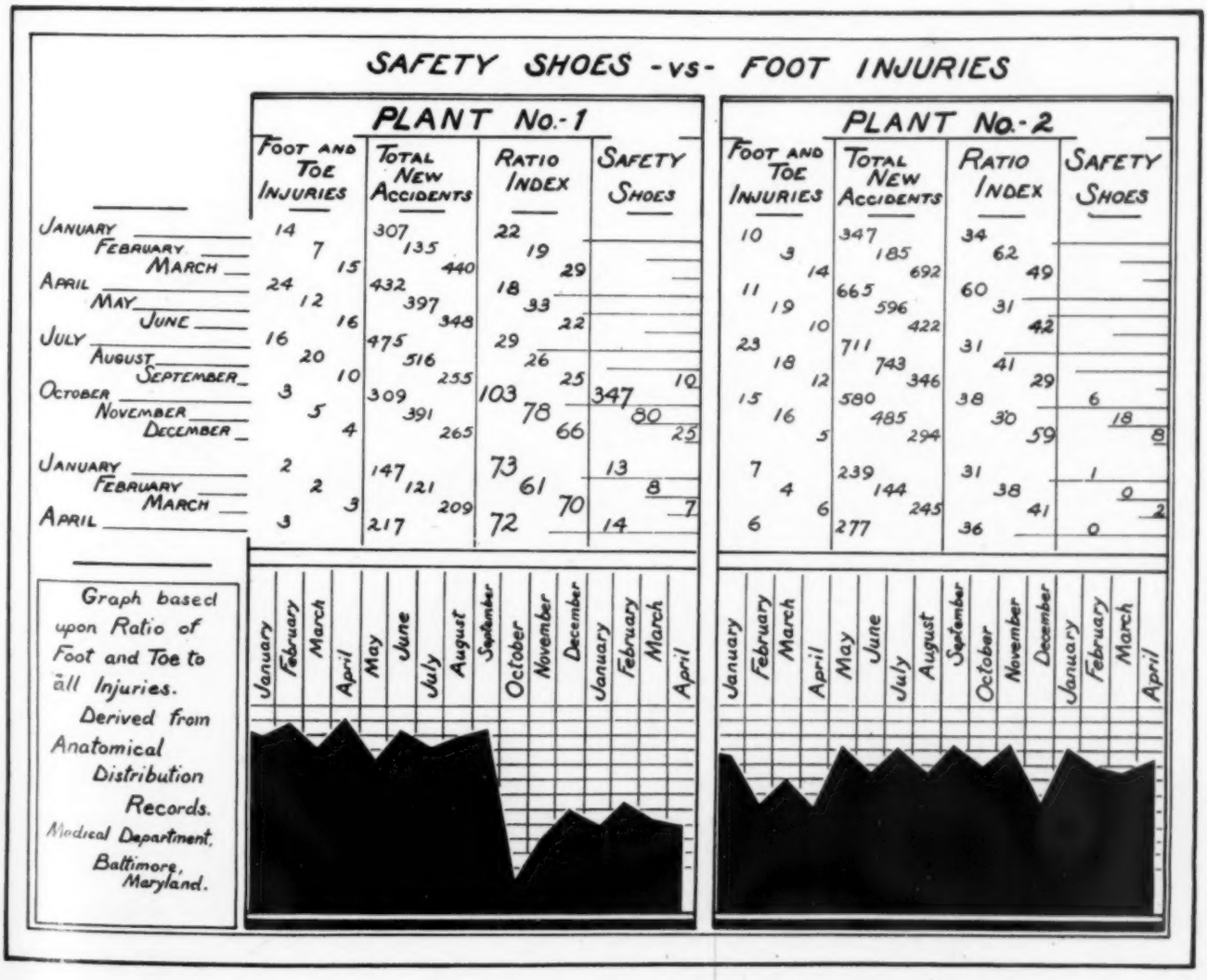


Fig. 7. A 16-Month Record of Foot and Toe Injuries

FREQUENCY (Frequency Index)

The number of man hours worked divided by the number of accidents occurring within that period of time equals the Frequency Index.

Example:

$$\frac{\text{Man hours worked} \ldots\ldots 4{,}338{,}582}{\text{New accidents} \ldots\ldots 1073} = 404.26 \text{ (Frequency Index)}$$

One new accident for every 404.26 man hours worked.

SEVERITY (Severity Index)

The number of new accidents divided by the number of those deemed severe equals the Severity Index.

Example:

$$\frac{\text{New accidents} \ldots\ldots 10{,}732}{\text{Severe injuries} \ldots\ldots 102} = 105.21 \text{ (Severity Index)}$$

One out of every 105.21 new injuries is severe.

LOST TIME (Index)

The number of man hours worked divided by the excess hours lost through injury within that period equals the Lost Time Index.

Example:

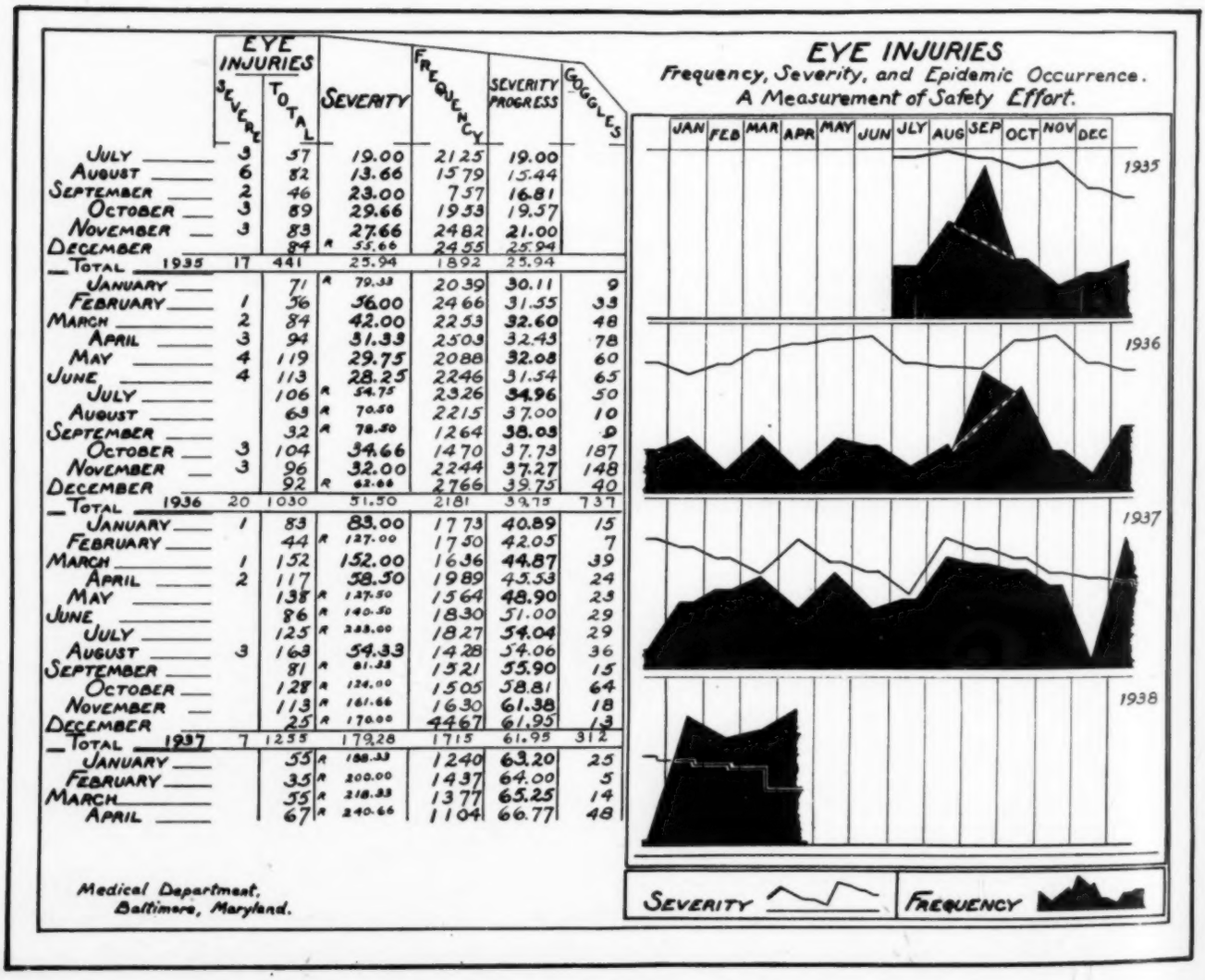
$$\frac{\text{Man hours worked} \ldots\ldots 4{,}134{,}832}{\text{Excess hours lost} \ldots\ldots 2985} = 1385 \text{ (Lost Time Index)}$$

One hour out of every 1385 man hours worked is lost through injury.

Fig. 8. Method of Obtaining Measuring Factors

there will be a wide divergence, but this will denote the variation in hazard and will indicate where the most help and effort are necessary. Keeping an accurate record of the excess time actually lost through injury will indicate the degree of severity. The man-hour, being a universal time unit, is used as the basis. It is simple and adaptable to all changes in working conditions, man power, and number of working hours. The method of obtaining our measuring factors is explained in Fig. 8. We will use these factors in a study of eye injuries.

In Fig. 9, frequency is represented by the solid curve and severity by the line. Only a few highlights will be pointed out. First, eye injuries are epidemic and usually increase in severity in the warmer months. December is generally the lowest month. Second, there is no consistent connection between frequency and severity. Third, consistent effort toward reducing injury shows results. Such effort was made from June to September in 1936, and from April to August in 1937. An intensive campaign was begun this last March and is still going on. The effects are indicated by the reduction in severity. The two peaks in frequency in September, 1935 and 1936, blocked off by the broken line, are a monument to the increase in accidents during plant change-



	EYE INJURIES SEVERE	EYE INJURIES TOTAL	SEVERITY	FREQUENCY	SEVERITY PROGRESS	GOGGLES
JULY	3	57	19.00	2125	19.00	
AUGUST	6	82	13.66	1579	15.44	
SEPTEMBER	2	46	23.00	757	16.81	
OCTOBER	3	89	29.66	1933	19.57	
NOVEMBER	3	83	27.66	2482	21.00	
DECEMBER		84	R 55.66	2455	25.94	
TOTAL 1935	17	441	25.94	1892	25.94	
JANUARY		71	R 79.33	2039	30.11	9
FEBRUARY	1	56	56.00	2466	31.55	33
MARCH	2	84	42.00	2253	32.60	48
APRIL	3	94	31.33	2503	32.43	78
MAY	4	119	29.75	2088	32.08	60
JUNE	4	113	28.25	2246	31.54	65
JULY		106	R 54.75	2326	34.96	50
AUGUST		63	R 70.50	2215	37.00	10
SEPTEMBER		32	R 78.50	1264	38.03	0
OCTOBER	3	104	34.66	1470	37.73	187
NOVEMBER	3	96	32.00	2244	37.27	148
DECEMBER		92	R 62.66	2766	39.75	40
TOTAL 1936	20	1030	51.50	2181	39.75	737
JANUARY	1	83	83.00	1773	40.89	15
FEBRUARY		44	R 127.00	1750	42.05	7
MARCH	1	152	152.00	1636	44.87	39
APRIL	2	117	58.50	1989	45.53	24
MAY		138	R 127.50	1564	48.90	23
JUNE		86	R 140.50	1830	51.00	29
JULY		125	R 233.00	1827	54.04	29
AUGUST	3	163	54.33	1428	54.06	36
SEPTEMBER		81	R 81.33	1521	55.90	15
OCTOBER		128	R 124.00	1505	58.81	64
NOVEMBER		113	R 161.66	1630	61.38	18
DECEMBER		25	R 170.00	4467	61.95	13
TOTAL 1937	7	1255	179.28	1715	61.95	312
JANUARY		55	R 188.33	1240	63.20	25
FEBRUARY		35	R 200.00	1437	64.00	5
MARCH		55	R 218.33	1377	65.25	14
APRIL		67	R 240.66	1104	66.77	48

Fig. 9. Frequency and Severity of Eye Injuries

over periods. There being a higher percentage of the supervisory force working during these periods, it is also a monument to their superior ability to hurt themselves. One more fact to be noted is that the number of goggles issued does not have the same effect on reducing injury as did the number of safety shoes. Men have to walk on their feet; they can see without goggles. Enforcing proper use and type of goggles gives the results.

One individual made 32 visits within a year for foreign bodies in the eye. He always stated he was wearing goggles. We observed this technically truthful worker; he was wearing his goggles—always on top of his hat.

Having determined the time best suited to attack any particular type of injury, the medical department can guide the safety activity in this manner. We will attack eye injuries. (Fig. 10.)

A map is spread out and the latest 100 eye-injury slips are taken from our Accident Prevention file and rapidly plotted. A general bulletin is issued on the condition, and all information is placed in the hands of those responsible for safety. To find the hazards no plant inspections by safety committees, followed by ponderous reports and loss of time, are necessary. Almost instantaneously a small group of tacks here indicates an epidemic and uncovers the cause—a recently installed and badly guarded bench grinder; another group points out the offender as an improperly protected exhaust from an air tool; another spots workmen using air pressure without eye protection; and a dozen other offenders are disclosed and eliminated. This little slip is the Alpha and Omega of accident control.

It furnishes what we term the three "W's" of safety, namely, "Who," "Where," and "Why." It constitutes the simplest, cheapest, and most efficient fire-alarm box, directing the safety engineer to the heart of the conflagration swiftly. It pays no deference to safety contest or to severity, but stands guard constantly over the safety of all. The smaller industries might make good use of it. We began with large words, presented formidable figures, and in the end we find the outstanding practical value in this one small slip.

In closing, I plead that the leaders in industry recognize the importance of a wider excursion of their medical departments into collective problems and that they afford the opportunity. It will be sound economy and good investment. Enter we must, for if we do not meet these problems from within, from without will come the experts—experts equipped with Marxian theories, loud voices, simian accusations, questions, and no answers. Voices growing ever louder because of our silence. The ears of the "More Abundant Lifers" will hear and believe. The thirty-percenters will support, with fanfare and much cheering. More

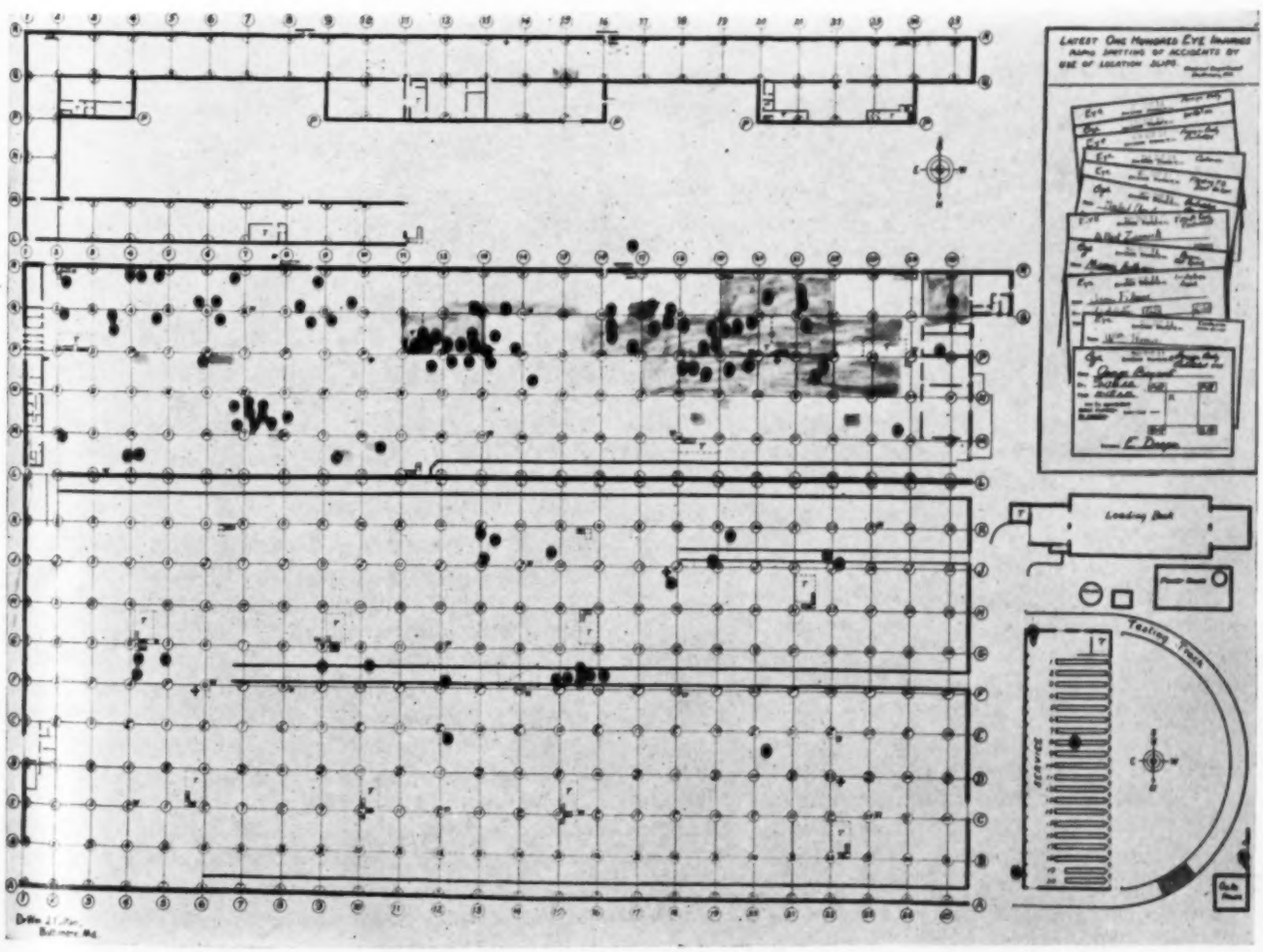


Fig. 10. Map of Places of Eye-Injury Occurrences

crack-pot legislation will be born. The 20% of a man's time that is given to earning his living will be acclaimed the cause of all mortality, and his employer will be held liable for all the ills to which, for countless ages, man has fallen heir—from pip to pox.

With shrugs of resignation, we will blame crooked politics instead of blaming our own inability to control such things. Earnest physicians, armed with truth and possessing the tradition of a broad view, can go far in promoting middle-of-the-road thoughts. As earnest citizens, they can and should go far in checking evils that may befall their nation. The basis of medicine is sympathy and the desire to help others, and whatever is done with this end must be called medicine.

THE BASIS FOR DETERMINING SEVERITY AND THE LOST TIME INDEX

Any injury that reduces the efficiency of the patient 50% or more, for any period over four hours, regardless of whether the individual is paid or continues work, is deemed severe.

All FRACTURES, DISLOCATIONS, and AMPUTATIONS are severe.

All LACERATIONS necessitating suture, regardless of extent of disability, are classed as severe.

EYE INJURIES necessitating more than one visit to the specialist are severe.

All INFECTIONS complicating compensable injuries and necessitating surgical drainage are severe.

All lost time in excess of the average allotted to the treatment of injury is recorded. An absentee because of compensable injury is charged with the actual time he would have worked, had the work been available (plant operating).

If, in the opinion of the physician, the injury did not arise out of and in the course of employment, the lost time is not recorded on the statistical sheet. A separate account is kept for such cases.

All determinations are to be based on sound, conscientious medical opinion, regardless of court decisions. It is to be remembered that the province of the courts is rendering legal decisions. Such decisions in nowise affect medical opinion.

Man-hours divided by New Accidents equals FREQUENCY.*

New Accidents divided by Severe Accidents equals SEVERITY.*

Man-hours divided by Excess Hours Lost equals the LOST TIME INDEX.*

Hour of Occurrence: The percentage of each hour, using the total as 100%, is used for plotting.

Anatomical Distribution: The RATIO INDEX is used for plotting. It is the result of dividing the number of injuries of any part of the anatomy into the New Accidents.

* The foregoing definitions refer to the author's own method of rating, and should not be confused with the commonly accepted meaning as used in standard safety statistics.

The Control of Lead in Duluxing and Metal Finishing Operations

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EXPOSURE to lead in metal finishing operations in the building of automobiles occurs in the application of solder to body joints in body building, and in the removal of the excess of this solder from these joints. Solder used for this joint filling contains approximately 75% of the pure metal, and approximately 24% of tin. A small amount of antimony, ranging from 0.2% to 1% is also a regular content, as well as minor percentages of impurities. The solder is applied to the joints by melting it in pots, from which the molten metal is transferred by ladles and paddles to the metallic joint. In the application process a torch flame is sometimes used.

The Society of Automotive Engineers specification No. 4 solder contains lead 73%, tin 24%, antimony 2%, and copper .08%. With this content solder is completely liquefied at 514° F. Larger amounts of antimony add to the malleability of the lead. Heating to a point above the melting point in the pot is unnecessary, as it favors vaporization and the escape of the lead oxide fumes. This lead oxide is the most poisonous lead compound used in industry, and gains entrance chiefly by the respiratory tract. In body manufacturing, however, if the temperature of the lead is not raised to the point of throwing off fumes to any extent, and if proper protection is given to the pots, by way of ventilation, little or no exposure occurs, and from the practical standpoint can be neglected. At least it has been our experience that men engaged for long periods at this type of work, applying the molten solder, have never developed lead poisoning, and only on rare occasions has the blood of these workmen shown any evidence of lead absorption.

The removal of this cold solder by hand tools, such as files, rasps, etc., likewise does not produce a hazard, probably because of the fact that the particles removed are large enough that they do not remain suspended in the atmosphere sufficiently long to favor inhalation. Also, the larger particles may not be absorbed as readily following inhalation. The mechanical removal, however, of this solder by the use of mechanically driven belts or discs is responsible for discharging into the atmosphere a fine lead dust, which creates in the immediate atmosphere, and also for varying areas about, a percentage of lead which is a real hazard. The lead constituent of this dust is pure lead. It is readily picked up by air currents, and for this reason may be conveyed to points quite distant from the origin, thus creating exposure to a large number of workmen. Excluding air currents, this dust is not likely to produce exposure 10 feet from the origin.

Exposure to this lead dust during the past five or six years has been responsible not only for a large amount of lead absorption, but also for a very definite number of clinical lead poisoning cases. The control or prevention of this hazard has been approached from many angles. The most attractive approach from the standpoint of medicine is the elimination of this toxic material from metal finishing, either by a more perfect metal joint or a malleable metal, non-toxic in character.

Some companies have found it possible to make a joint, eliminating almost entirely the use of this media. The second method of control adopted by some companies has been the elimination of the mechanical removal of the solder, reverting to manual tools in the process. When this is done no hazard is found to exist. This method in comparison with mechanical removal is, however,

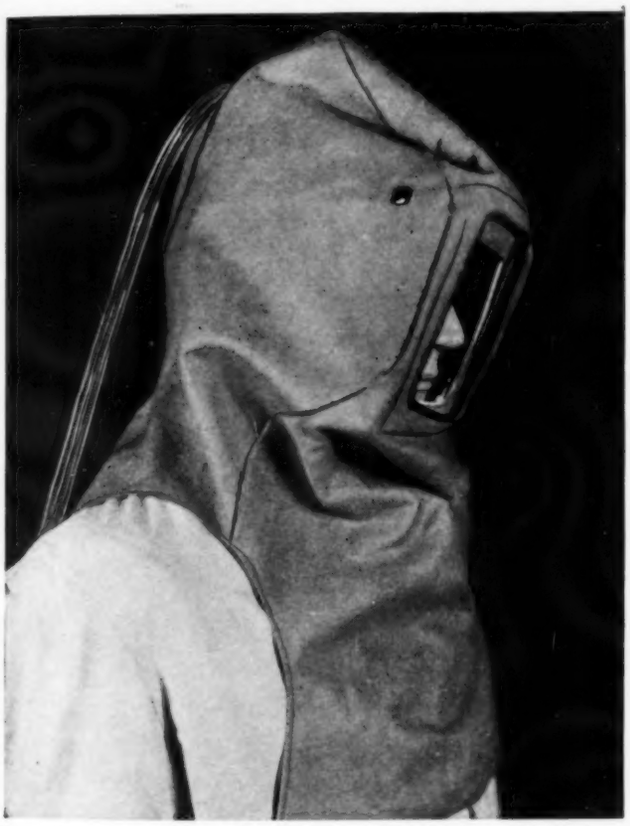

Fig. 1.
Air Helmet with Canvas Hood and Cellulose-Acetate Visor

expensive and most production divisions have not seen fit to eliminate the mechanical process. Many contrivances have been devised to minimize or aim at the elimination of the contamination of the air produced by these mechanical sanding and discing machines. They might briefly be mentioned as follows:

1. Forced exhaust ventilation in the region of the belt sander materially reduces the escape of dust from the sanding belt, but is by no means an adequate protection, because even with this device in operation the air in the region of the sanding machine ranges all the way from 85 mg. to 400 mg. of lead per 10 cubic meters of air.

2. To reduce the amount of escaping dust from the discing machine, a so-called wet discing process has been devised in which water discharges from a contrivance in the center of the disc, moistening the separated material and lowering the

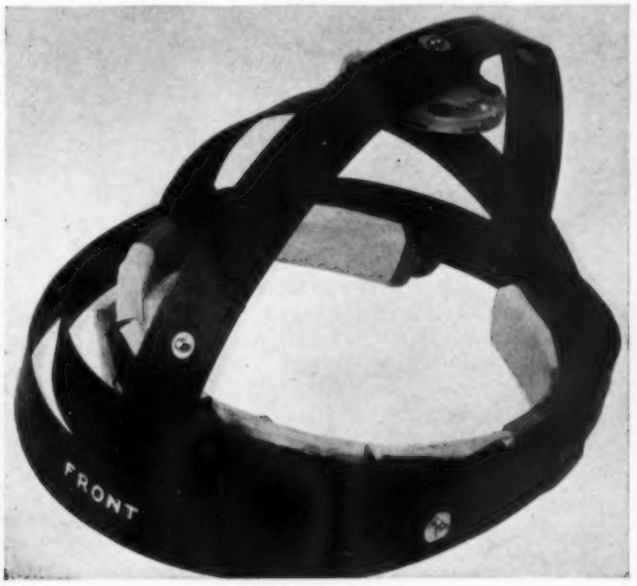

Fig. 2
Head Gear for Air Helmet, with Air Jet Attached

production of dust. This again is found to be inadequate, as the amount of lead in the air in the vicinity of such an operation may range all the way from 20 to as high as 1800 mg. of lead per 10 cubic meters of air. Accepting 2 mg. in 10 cubic meters of air as a reasonably safe maximum you can readily see that the condition, even with these devices, makes discing and sanding operations extreme hazards, not only for the immediate operators, but for those in the immediate vicinity

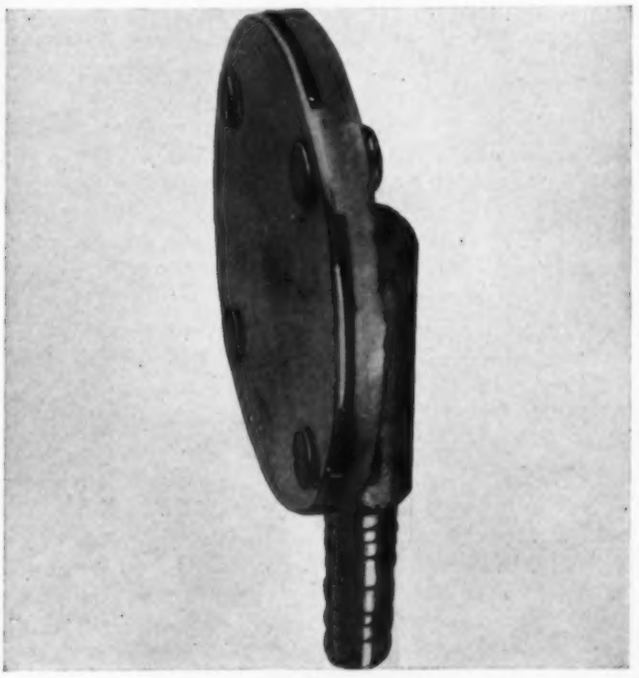

Fig. 3.
Air Jet for Air Helmet

and, if currents of air exist, over very large work areas.

3. Various respirators and helmets, as protectors to the operator of these mechanical devices, have been used. The various forms of filter masks, if properly used, are a real protection, but are far from being perfect, because of the human element in their use and because of exigencies of production, making their use at times difficult or their regular use uncertain. The use of positive pressure helmets, made of a relatively impervious material, such as is shown in Figs. 1, 2, and 3, seems at present the most practical method of protection for the immediate operator. Air taken from the inside of one of these helmets in use in a contaminated area revealed an analysis of 1.6 mg. of lead per 10 cubic meters of air. The use of these helmets

Fig. 4.
Discing Chamber, Exterior

provided with proper exchange of air, under desirable pressure and distribution of air at the entrance, has been found by operators to be very comfortable and satisfactory in use. They do not, however, protect the distant unprotected operator at other work.

4. As a protection to other operators, if this dust is being created, the process must be sufficiently segregated to prevent the escape of dust to other areas. The hanging of curtains, the building of partitioning tunnels or tunnel-like structures, segregating chambers or booths, have all been tried. The success of these methods varies with the construction of the booth, chamber, or tunnel-like structure, and the rate of air exchange within such a structure. Figs. 4 and 5 show pictures of a chamber for this purpose, used satisfactorily for automobile bodies.

This chamber is approximately 92 ft. x 14 ft. x 12 ft. high, and is of metal and glass construction. Air is exhausted by ducts with outlets located near the floor. Air entry takes place at the two end openings required for the entry and exit of cars, and by ducts located in the roof of the enclosure. The air entering by ducts comes directly from the outside through heating coils, no fans being used for propulsion. The calculated air exchange in this enclosure is two changes per minute. The air is exhausted to the outside atmosphere. It is estimated that approximately 60% to 70% of the air entering the enclosure comes through the opening at the end, and the balance through the roof ducts from the outside. The chamber readily accommodates 18 workmen. Provision is made for the wet cleaning of the floor in this discing chamber. Each workman is provided with air supplied helmets. These helmets are made of a relatively impervious canvas with a large visor of cellulose acetate, as shown in Fig. 1. The cloth helmet is held in position by a head gear as shown in Fig. 2. These helmets are washed frequently and kept in good condition. The jet for the entrance of air into these helmets is placed in the top of the head gear and has multiple lateral exists. (See Fig. 3.) Each

Fig. 5.
Discing Chamber, Interior. Air Helmets in Use

workman has a separate gauge from the supply air line, which is under a pressure of 35 pounds. Workmen are permitted to operate their own gauges at pressures ranging from 20 to 35 pounds. This provides air at at least 6 cubic feet per minute.

Table I gives a report of air analysis outside the discing area, before and after the building of this chamber.

Table II gives a report of the air analysis inside the discing room and inside one of these air helmets when in use.

Table III gives a comparative experience in the control of lead in metal finishing in automobile body manufacture for the years 1936-1937 and 1937-1938.

The preventive measures for the control of lead in metal finishing operations may be briefly summarized as follows:

1. Eliminate the use of lead by:
   (a) Perfecting a hard metal joint.
   (b) Substituting a non-toxic malleable metal.
2. Care of solder pots by:
   (a) Ventilation.
   (b) Temperature control.
3. Prohibiting the use of mechanical removal of solder and permitting the use of manual tools only.

TABLE I.

REPORT OF AIR ANALYSIS OUTSIDE DISCING AREA BEFORE AND AFTER BUILDING BOOTH

BEFORE

Lab. No.	Location	No. cubic feet air	Mg. Pb. per 10 cubic meters
2923B	In aisle—general 20 ft. from operation	32.28	2.6
2923E	6 ft. south of partition where sanding and discing machines are used—general shop dust	41.33	5.7
2923F	30 ft. east of partition (between posts) where sanding and discing machines are used — general shop dust	42.87	1.5

AFTER

Lab. No.	Location	Volume of air sample—cubic feet	Mg. Pb. per 10 cubic meters
3414A	Outside discing tunnel, one foot from entrance	24	1.2
3414B	10 ft. from entrance	30	0.97
3414C	Outside discing tunnel, one foot from exit	25	2.43

4. Protecting the workmen mechanically removing solder by:
   (a) Segregation in an air conditioned chamber.
   (b) Use of air helmets.
   (c) All routine precautions against lead, such as cleanliness, change of clothing, etc.
   (d) Periodical clinical and blood examination of workmen.

TABLE II.

REPORT OF AIR ANALYSIS INSIDE DISCING BOOTH

Lab. No.	Location	Volume of air sample—cubic feet	Mg. Pb. per 10 cubic meters
3414D	In discing chamber between head of operator and sanding machine	25	167.5
3414E	In discing chamber between face of operator and discing machines	25	1833.0
3415A	Inside helmet of discer. Volume of air supplied to helmet 6.5 CFM	21	1.6
3415B	Inside discing chamber, near sanding machine and 1st discer, impinger protected from coarse dust being thrown by discing machine	25	10.4
3415C	Same as 3415B only impinger not protected from coarse dust being thrown by discing machine	36	74.4
3415D	Inside discing chamber, near discers and between exhaust ducts, impinger protected from coarse dust thrown by grinding machine	27	10.8
3415E	Same as 3415D only impinger not protected from coarse dust thrown by grinding machine	25	6.7

TABLE III.

COMPARISON OF LEAD ABSORPTION EXPERIENCE IN METAL FINISHING, 1936-1937, 1937-1938

	1936-1937	1937-1938
Units manufactured	26,020	22,122
Number of men observed	78	34
Blood smears examined	396	92
Workmen having absorption	26	0
Clinical cases of lead poisoning	4	0
Clinical cases compensated	3	0
Workmen removed from exposed area	15	0
Protective Measures:	1. Segregation by partitions 2. Filter respirators 3. Wet discs 4. Belt sander exhausts	1. Air conditioned chamber 2. Air helmets 3. Wet discs 4. Belt sander exhausts

In duluxing processes exposure to lead occurs from the application by spray of paint containing lead pigments. Fortunately most of these paints do not contain a high percentage of the pigment. Lead chromate, lead sulphate, and in smaller quantities the basic carbonates, are the pigments used of lead origin. These pigments vary in their toxicity, the basic carbonate being the most toxic. The lead sulphate and chromate have about the same degree of toxicity, but are decidedly less toxic than the carbonates and are used in much larger quantities. They are all only slightly soluble in the water. The danger does not result, however, only from their solubility, but from their capacity to form dust. The content of these lead pigments,

TABLE IV.

LEAD PIGMENT CONTENT OF DULUX PAINTS

PASSENGER COLORS		
Black	AUX4008	X
Oshawa Blue Dark	AUX4108	X
Coronation Maroon	AUX4123	X
Buckingham Grey	AUX4125	X
Avenue Green	AUX4120	Approx. 6%
Sun Ray Tan	AUX4122	X
Windsor Green	AUX4126	Approx. 2%
Ensign Blue	AUX4124	X
Classic Blue	AUX4121	X
Regal Blue	AUX4133	X
Black (New)	AUX4134	X
TRUCK COLORS		
Black ½ hr.	AUX1105	X
Oshawa Blue ½ hr.	AUX1104	X
Comm. Maroon ½ hr.	AUX1103	X
Comm. Cream ½ hr.	AUX1106	Approx. 2%
Comm. Red ½ hr.	AUX1102	X
Comm. Blue ½ hr.	AUX1100	X
Comm. Green ½ hr.	AUX1101	Approx. 10%
Comm. Maroon (New) ½ hr.	AUX1107	X
White 1 hr.	AUX548	X

X—These contain none or traces only of lead pigments, the percentage in all cases being substantially less than 1%.

Lead pigments include lead chromate and sulphate in about equal amounts, with a very small amount of basic carbonate.

as used in the various paints in automobile building at present, is found in Table IV. Yellow and green colors are readily seen to be the greatest offenders. These colors are used chiefly for truck bodies and machinery.

TABLE V.
ANALYSIS OF DISCS AND BLOOD SMEARS, DULUX OPERATORS

Disc	Hrs. in Use	Dulux Color	Article Sprayed	Pb. per Disc	$MgSb_2O_3$ per Disc	Per Cent Basophilic Aggregation Cells
1. D. G...	2	W. G. (2%)	P. Body	5. mgs.		.6
2. D. G...	2	"	"	4.8 "		1.
3. R. M..	1	Mixed	"	.55 "	3.60	.8
4. H. J...	1	"	"	.59 "	5.04	.6
5. E. H...	1	"	"	.30 "	7.20	.35
6. A. R...	1	"	"	.42 "	8.64	.4
7. A. N...	3	"	"	.58 "	49.68	.4
8. J. N...	2	C. G. (10%)	T. Body	1.3 "		1.3
9. J. N...	2	"	"	2.2 "		1.1
10. R. B...	3	Mixed	"	1.85 "	2.16	.8
11. D. C...	3	"	"	.55 "	1.44	.4
12. J. S....	3	"	"	3.22 "	4.32	.7
13. B. R...	3	"	"	2.34 "	4.30	1.
14. H. K...	3	"	"	1.48 "	2.88	1.1
15. E. S...	3	"	S. Metal	.56 "	5.76	.3
16. H. S...	3	"	"	.37 "	0.70	.4
17. A. C...	3	PRIMER	T. Body	1.04 "	1.08	.4

In the application of these delux paints by spray in booths, as is commonly the practice, even with the best type of air changing or ventilation, a workman is exposed to a high content of the finely divided suspended particles of pigments, including the lead chromate, lead sulphate, and the basic carbonates. Both for the comfort, as well as for the protection against the lead, some form of a respirator is essential. Filter respirators of various types are in use, and appear to give satisfactory protection. Table V shows the percentage of lead content of respirator discs used for various periods, and with various colors of dulux. The analysis of the lead content in these discs readily points to the absorption which might occur without their use. The antimony content of these discs, as shown in Table V, is likely of little significance, as antimony, used as freely as it is to-day, likely has a very low toxicity index. The high content of lead found in the respirator discs of dulux sprayers, and the lack of evidence of absorption, as is shown by the blood smears of these operators, would point to the fact that the filter pads or discs are extremely efficient, or the lead pigments in these paints have a very low toxicity. Without proper protection absorption has, however, occurred in dulux operators and as long as these paints contain the lead pigments, protection must be given.

The use of lead pigments in primer and surfacer paints has for the most part been discontinued. Satisfactory substitutes for lead pigments in dulux paint can, should, and will be found. With a little research work, zinc pigments might be substituted today for some of the lead pigments being used, and such substitution wherever practical and possible should be advocated.

The use of these filter respirators, as in all processes involving lead, is a somewhat unsatisfactory protective measure for the following reasons:

Fig. 6.
Air Helmet with Air Visor

Fig. 7.
Air Visor Helmet:
(a) Hood (b) Head Gear
(c) Jets for Production of Air Visor

1. They are uncomfortable.
2. They do not fit all faces equally well, and may allow air to pass margins.
3. They materially reduce the air exchange necessary for normal respiration, and are consequently unhealthy and decrease work capacity.
4. Workmen cooperate poorly in their use for the above reasons.

Air helmets with ordinary visors as are used in sand blasting and in mechanical removal of solder, and in the application of primer, etc., can not be used for this particular process of applying dulux paint, because the visors become smeared very rapidly, prohibiting vision. The use of these helmets without a visor is a partial protection from the standpoint of cleanliness, but does not prevent inhalation of the lead pigments. Taking advantage of the principle of the use of an air current or curtain used in the doors of dulux baking ovens, one of our safety directors, Mr. White, has ingeniously devised an air helmet which may prove to be of real value for such a process. Figs. 6 and 7 show this helmet. Air under 30 to 80 lbs. pressure is given exit through multiple openings about the visual field, as well as through one vent within the helmet for respiration. The curtain produced by 30 lbs. will protect against a rebounding spray, while greater pressures are needed if exposure to direct spray exists.

Another exposure to lead has occurred in a type of work related both to metal finishing and to dulux application. This work is termed "putty glazing." This glazing consists of the application of a putty to metal surfaces, both prior to and after the application of primer and surfacer coats. The putty used for this particular operation may or may not contain lead. Some putty used for this purpose contains a 60% pigment of which over 50% may be basic lead carbonate. Workmen handling this putty may in a relatively short time absorb considerable lead to the point of toxemia. This, however, is quite unnecessary, as satisfactory lead-free putty can be obtained for this process.

Even making use of all of the preventive measures mentioned does not eliminate the necessity of employing, in both duluxing and metal finishing, able-bodied men with good living habits, and periodically examining these men for the possibility of lead absorption. The periodic examination of workmen possibly exposed to lead should include both clinical and laboratory examination. Of primary importance in the laboratory examination is the examination of carefully made blood smears for the detection of the early changes which occur in red cells, as a result of lead absorption. This change may be detected either by a stippled cell count or by the percentage of basophilic aggregation cells. The latter is somewhat more sensitive, more accurate and more practical, providing a definite care and routine are taken in the technique. If a number of workmen are being examined, the smears may be taken with the least loss of time by a technician actually obtaining the smears near where the men are at work. The clinical examination, however, should be carried out in a plant examining room or hospital, and should include weight, blood pressure reading, grip reading, observation of mucous membranes, and, if necessary, hemoglobin estimation. If lead absorption is even remotely possible blood smears should be taken at least every two weeks and clinical examination made once a month. Individuals having a basophilic aggregation of 1.5% and below need not be given special care. Individuals ranging between 1.5% and 2% should be under closer observation, and those with 2% and above should be carefully scrutinized and removed from exposure.

Preventive measures for the control of lead in duluxing operations may be briefly summarized as follows:

1. The use of lead-free putty in "putty glazing."
2. The use of dulux paint containing low lead content, substituting wherever practical and possible zinc pigments for lead.
3. The use of properly ventilated spray booths.
4. The use of respirators:
   (a) filter masks;
   (b) air helmets with air visors.
5. Periodical clinical and blood examinations of workmen.

Dermatitis from Cutting Oils and Compounds

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DERMATITIS in the broad sense of the term is the most frequent of all occupational diseases, and that caused by cutting oils and compounds is one of the chief offenders. Wherever grinding and machining operations take place, these cutting fluids are necessary to minimize the heat caused by the friction of the cutting tool and the steel, and grinding wheel and the metal. These oils vary in composition in different industries, but in general are composed of mineral oil, saponifiable oil, sulphur, and paraffin. The compounds are made up of mineral oil with emulsifiers which made them soluble in water. Their chief function is to act as coolants without causing rust and without fouling the machines. In most plants, these fluids are reclaimed, clarified, and sometimes sterilized and used over and over again. Ordinary cutting oils may be satisfactorily sterilized by heat and clarified by mechanical filters such as the DeLaval apparatus. The com-

pounds cannot be effectually sterilized, but they may be clarified by filtration through burlap bags or mechanically by the DeLaval centrifuge.

These fluids are not good culture media, but in the used oil, one frequently finds bacteria such as B. coli, streptococcus, and staphylococcus. Irradiation and chemical germicides have been tried, and both have been found to be ineffectual. In the case of the latter, the chemical if added in sufficient concentration to prevent the growth of bacteria often becomes a skin irritant itself.

Ten years' survey in a large industrial plant in New England has brought out the following facts regarding oil dermatitis. The incidence of this condition was not high. It varied from one-tenth of 1% to 2.7%. In 1937, 2000 men were exposed to these cutting fluids with an incidence of 1.7%.

The typical lesions caused by oil are often referred to as oil acne, oil pimples, or blackhead itch. The trouble starts as a comedo in the opening of the hair follicles. Following this, there develops a macular lesion which rapidly becomes a papule through which the hair may protrude. These papules are discrete, reddish in color, often symmetrical in distribution, and ordinarily found on the forearms, backs of the hands, and the anterior parts of the thighs: those parts of the anatomy which come in intimate contact with the oil. The careless worker often shows papules on his face, forehead, and neck after wiping these parts with his oily hands. This disturbance usually subsides if properly treated, but sometimes results in a pustular eruption which is probably a secondary infection produced by scratching or other injury to the skin. Eczematoid lesions do not follow this condition as a rule. Most observers familiar with this condition believe that the basic cause is a mechanical plugging of the pilosebaceous apparatus. Theoretically, it is assumed that the oil sets up an irritation in the pilosebaceous mechanism, producing hyperkeratosis (a horny plug) and a malstimulation of the gland itself. The exact pathology is not clearly understood. Probably several factors are involved. Constituents of the oil such as sulphur, free alkali, minute particles of steel carried into the follicles, dirt and bacteria from the surface of the skin are all contributing factors in the picture. The fact that the primary lesion is not pustular would lead one to believe that the basic cause is not one of bacterial origin. Cultures taken from the comedo have been found to be sterile by most observers. Against the theory that the oils cause sensitivity is the negative patch test. I have never been able to produce a skin reaction with cutting oil or compound, and I believe that this result coincides with dermatologists who have made extensive tests of this nature. The eruption itself is not characteristic of an allergic reaction. Two English writers, White and Little, have mentioned the excess of alkali as an exciting factor in dermatitis, and these men also speak of the danger of skin cancer from the use of mineral oil, particularly in the cotton spinning industry in England. We have had no incidence of cancer from cutting oil or compounds.

If, then, we accept the theory that this cutaneous disturbance is largely one of dysfunction of the pilosebaceous apparatus produced by mechanical plugging and irritation of the sebaceous gland from without, the principle in treatment should be based on the above contention. The ideal situation would be to make conditions so perfect that it would be impossible for the worker to come in contact with oil. At the present moment this possibility appears to be in the realm of mechanical fantasy. The next best proposition would be the possession of occult power enabling the employment personnel to select the type of worker who is neat and clever in his manipulations, and one whose skin is by nature resistant to this type of irritation; for there is little doubt in my mind that the sloppy worker is the one most often afflicted with this disturbance. Two men on the same type of machine, going through the same motions, present striking contrasts in appearance at the end of a day's work—one will be literally saturated with oil, his pants and shirt will be soaked, and he will even have it behind his ears. The other will be free of the irritating fluid except on his hands and forearms. It has been said that the individual of blond characteristics in the acne age is susceptible, also that men with dry skins are more liable to this difficulty. The truth of this has not been demonstrated in my experience.

Prevention consists in the proper instruction of the employee in the cleansing of his hands and forearms and the providing of adequate facilities for carrying this out: suitable washbowls, clean wiping cloths, hot water, and non-irritating soaps. Once the condition has developed, the patient may be treated while at work unless secondary infection ensues, in which case, he should be removed from contact with oil. The intense itching may be controlled by calamine lotion or similar antipruritic agents. The use of protective substances such as lanolin, olive oil, and commercial pastes such as Flex-O-coat and Ply may be applied to the skin after thorough cleansing. There is some doubt concerning the advantage of this procedure, but in any event, it may afford some protection, and it forces the men to give themselves thorough cleansing in order to get rid of the coating.

Oil dermatitis is not a serious, but a troublesome, occupational disease and one that is fairly easily controlled if adequate instruction in the hygiene of the skin cleaning is given the worker, and adequate facilities for its consummation are provided.

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The W. S. Knudsen Award

—For the Most Outstanding Contribution to Industrial Medicine—

WILLIAM S. KNUDSEN, President of General Motors Corporation, caused it to be announced at the Twenty-Third Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, at Chicago, in June, that he is making an award to the industrial physician who, by the time of the next Annual Meeting, in 1939, shall have been responsible for "the most outstanding contribution to industrial medicine."

"There is no argument about the value of medical service in industry," MR. KNUDSEN said, in an interview following the meeting. "The more we improve health conditions in plants, the more we improve health conditions in general. The man who has the benefits of a health maintenance program in his work must inevitably carry some part of what he learns there home with him.

"Many years ago I, myself, was the entire first aid department in a plant where 800 people were employed. The progress since those days has been more than tremendous, as we in industry know. With the desire to concentrate and crystallize the attention of the medical and industrial world on the wonderful progress that has been made and is being made in industrial medicine, I am glad to announce an award to be given to the industrial physician making the most outstanding contribution to industrial medicine."

Pursuant to MR. KNUDSEN's announcement, the President of the American Association of Industrial Physicians and Surgeons appointed the Association's "Committee on the Knudsen Award"—the Chairman, DR. LOYAL A. SHOUDY, Chief of Medical Service, Bethlehem Steel; the members, DR. MCIVER WOODY, Medical Director, Standard Oil, New York, and DR. C. F. N. SCHRAM, Medical Director, Tennessee Eastman Corporation.

Both Mr. Knudsen (at the left) and Mr. Sloan (center) have the modern executive's intimate knowledge of the value of medical service in industry

The Industrial Physicians and Surgeons

—Some More of the Papers and Discussions, at the Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons, and Second Midwest Conference on Occupational Diseases, Chicago, June 6, 7, 8 and 9, 1938—

FOLLOWING, in the sequence of their places on the Program, are three more of the papers and discussions from the Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons and Second Midwest Conference on Occupational Diseases, at Chicago, June 6, 7, 8, and 9, 1938. The 13 papers and discussions which were published in the July issue are so indicated in the full list by the references to the pages on which they appeared. The three more included in this issue (from page 518 to page 528) are designated by their page numbers in *italics*.

Monday, June 6.

UNDER the chairmanship of DR. C. O. SAPPINGTON, the following papers were presented:

"The Engineer's Place in Industrial Hygiene," by WARREN A. COOK, Supt. Engineering Dept., Zurich General Accident & Liability Insurance Company, Ltd.

"The Insurance Company and the Control of Occupational Diseases," by J. B. LAMENZO, Research Engineer, Hartford Accident & Indemnity Company. (July, page 370.)

"The Physician's Responsibility in Industrial Hygiene," by C. D. SELBY, M.D., Medical Consultant, General Motors Corporation. *(Page 519.)*

"Engineering Aspects of Problems in Industrial Epidemiology," by J. J. BLOOMFIELD, P. A. Sanitary Engineer, Division of Industrial Hygiene, U. S. Public Health Service. (July, page 377.)

"Plumbing as an Industrial Hygiene Problem," by MAJOR JOEL I. CONNOLLY, Assistant to the President, Chicago Board of Health.

"Industrial Hygiene and the Nurse," by JOANNA M. JOHNSON, R. N., Supervisor of Nurses, Employers Mutuals, Wausau, Wisconsin. (July, page 385.)

AT THE evening meeting, at which DR. CAREY P. MCCORD presided, WILLIS H. CARRIER, Chairman of the Board, Carrier Corporation, read his paper on "Air Conditioning in Industry."

Tuesday, June 7.

WITH DR. WM. D. MCNALLY as Chairman of the morning Session, and DR. ANDREW M. HARVEY presiding during the afternoon, the following presentations were made:

"Contact Dermatitis," by MICHAEL EBERT, M.D., Associate Professor of Dermatology, Rush Medical College.

"Practical Problems Under Blanket Coverage for Occupational Diseases: A Review of the Illinois Claim Experience," by CLARK BRIDGES, Casualty Mutual Insurance Company. (July, page 390.)

"Noise in Industry," by ROBERT LINDAHL, the Celotex Company.

"Developments in Occupational Diseases Legislation," by OLIVER G. BROWNE, General Claims Attorney, New York Central System. (July, page 394.)

"Women in Industry," by M. H. KRONENBERG, M.D., Chief of Division and Industrial Medical Supervisor, State of Illinois Department of Public Health.

"Light, Vision, and Seeing," by MATTHEW LUCKIESH, D.Sc., Director, and FRANK K. MOSS, Physicist, Lighting Research Laboratory, General Electric Company.

"Tuberculosis and Its Relation to Silicosis," by O. A. SANDER, M.D. (July, page 399.)

"The Employability of the Silicotic," by VOYTA WRABETZ, Chairman, Industrial Commission of Wisconsin. (July, page 405.)

Wednesday, June 8.

THE Twenty-Third Annual Meeting of the American Association of Industrial Physicians and Surgeons was opened officially by the President's Address of DR. ROYD R. SAYERS. (July, page 410.)

DR. FREDERICK W. SLOBE was Chairman during the morning, and DR. CASSIUS H. WATSON presided, during the afternoon, while the program prepared and presented by the Association for the Advancement of Industrial Medicine and Surgery—which began with DR. CURRENCE's paper—was given.

The morning program was as follows:

"Hazards of Night Driving," by HART E. FISHER, M.D., F.A.C.S., Medical Director, Chicago Rapid Transit Company. *(Page 522.)*

"Factors Determining Reasonable and Equitable Temporary Total Disability Periods," by PHILIP H. KREUSCHER, M.D., F.A.C.S., Chief Surgeon, Chicago Area, Carnegie-Illinois Steel Corporation; Former Medical Director, Industrial Commission of Illinois. *(Page 525.)*

"The Occupational Diseases Research Department of Northwestern University," by FRED FITZ, M.D., Northwestern University Medical School.

"Syphilis in Industry," by HAROLD A. VONACHEN, M.D., Medical Director, Caterpillar Tractor Company. (July, page 416.)

The afternoon program included:

"Arthritis in Industry," JOHN D. CURRENCE, M.D.

"Tuberculosis in Industry," by GEORGE G. ORNSTEIN, M.D., F.A.C.P. (July, page 419.)

"Intra-Articular Damage," by WILLIS W. LASHER, M.D., F.A.C.S.

"Lead Poisoning in Industry," by IRVING GRAY, M.D., F.A.C.P.

THE Annual Banquet, with DR. WILLIAM A. SAWYER presiding, featured the paper by HARVEY G. ELLERD, Personnel Director of Armour and Company, on "Employability of Persons Presenting Disability or Disease." (July, page 430.)

Thursday, June 9.

WITH DR. C. D. SELBY, as Chairman, the program of the Institute of Traumatic Surgery was as follows:

"Discussion of Fat Embolism," by CARLO S. SCUDERI, M.D., F.A.C.S. (July, page 436.)

"Trauma to Blood Vessels, and Their Sequelae," by RAYMOND W. MCNEALY, M.D., F.A.C.S.

"Distinction Between Injuries of Spine, Spondylitis, and Spondylosis," by JOHN D. ELLIS, M.D., F.A.C.S.

"Pectin in the Treatment of Wounds," by JAMES E. M. THOMSON, M.D., F.A.C.S. (July, page 441.)

"Metallic Fixation of Bones," WILL T. LYON, M.D.

In the afternoon the Chicago Regional Fracture Committee of the American College of Surgeons, with DR. E. C. HOLMBLAD as Chairman, gave the following symposium:

"Fracture of the Carpal Navicular Bone," by KELLOGG SPEED, M.D., F.A.C.S.

"Prevention vs. Cure in Deformity Following Fracture," by PAUL B. MAGNUSON, M.D., F.A.C.S.

"March Foot," by DEAN L. RIDER, M.D.

"Treatment of Fractures of the Neck of the Femur by Pinning," by WILLIS J. POTTS, M.D., F.A.C.S.

"Treatment of Fractures of the Neck of the Femur," by HUGH MCKENNA, M.D., F.A.C.S.

The Physician's Responsibility in Industrial Hygiene

C. D. SELBY, M.D.,
Medical Consultant,
General Motors Corporation,
Detroit, Michigan

I FIND it difficult to define the responsibility of the physician in industrial hygiene. It would be easier to define his opportunity. It can be agreed without question that he is responsible for the maintenance of health. Theoretically he should, therefore, be responsible for the detection and possibly the correction of conditions that impair health. But I wonder if he is prepared to assume that responsibility.

As a matter of fact, the study and correction of conditions that cause diseases, aggravate pre-existing diseases or in any wise impair health in industry require rather more of chemical and engineering knowledge than medicine is prepared to furnish. For this reason physicians, with a few notable exceptions, have not developed proficiency in the field. On the other hand, engineers have seen the opportunity, have found it to their liking, and have won recognition. In doing so, they have innocently succeeded in limiting our conception of industrial hygiene to the application of engineering principles in the control of unhealthful working conditions and environments.

This apparent transmutation of industrial hygiene from medicine to engineering has allowed the physician to assume a less prominent position than his knowledge and experience would justify. The important question now is, whether he has any responsibility toward industrial hygiene, and, if he has, to what extent?

This question must be considered from a practical point of view, and for that purpose the doctor in industry must himself be analyzed.

There are three groups of physicians practicing in industry—full time, part time, and those who respond only to requests for service, commonly designated as physicians on call. This last group are the general practitioners and specialists who treat injured and sick workmen when requested. Their industrial service being only incidental to their private practice, they are not in reality industrial physicians, yet they serve about 85% of the industrial establishments.

The part-time group are those who allocate definite periods of time to service in one or more plants. Usually they give their time to case work and physical examinations. For the most part they also are general practitioners or specialists, and with few exceptions may be regarded as such.

The full-time group, as the name indicates, give their whole attention to industrial practice and always in one establishment. They are the only truly industrial physicians who, as a group, apply the principles of preventive medicine to the maintenance of employee health. Of these three groups, it is difficult to understand how any except the full-time physicians are in a position to assume appreciable responsibility in industrial hygiene. The extent to which they do or can depends upon their knowledge, vision, professional ability and capacity to organize or fit into the organization that employs them.

Physicians of the other two groups, part time and on call, should frankly admit their dependence upon the industrial hygienists, but though admitting dependence, they should be sufficiently informed in the principles of industrial hygiene to interpret and use the information obtained by engineering methods.

A physician approached me recently. "I do the work for a small battery plant." he said, "take care of the injuries. you know. The other day, the owner asked me what he should do to protect his workmen against lead. Do you know," the doctor added, "I don't know how to advise him. I haven't the slightest idea what to do."

"Why, that's easy," I said. "Tell him to consult an industrial hygienist."

"What's an industrial hygienist?" asked the doctor.

The weak spot in the scheme of industrial medicine, as applied to the entire working population, is in these general practitioners who serve industry occasionally—and bear in mind they serve a large percentage of the plants. They do very well in the treatment of injuries and fairly well in the treatment of occupational diseases, but with a background of little or no plant knowledge, it is difficult to see how they can perform the functions of industrial hygiene or assume intelligent directing or advisory relationship to the solution of the hygiene problems of the plant.

The full-time doctor on the other hand, is integrated with the plant organization, and he is in a position to develop an industrial hygiene service in his own department or in some other department, say the engineering or chemical, to work with him. Although now admittedly a part of the field of engineering, industrial hygiene is definitely related to the medical problems of the plant. It is therefore always with regret that I see a full-time plant physician permit the function to escape from him. He may be neither prepared nor have the time to carry on the technical work in making industrial hygiene studies. Nevertheless, I am convinced that the function belongs in the medical department and that it should be set up as a divisional or sectional activity, the reports to go to the doctor and he to set the machinery of correction in motion.

I regard the physician as the health officer of the plant. He is responsible for the maintenance of employee health. It necessarily follows that he is responsible for identifying and determining the significance of occupational and environmental conditions that impair health and the limits to which workmen can be exposed with safety. His responsibility is not discharged when he has directed management's attention to harmful conditions. It is equally essential that he follow up until correction is effected and, furthermore, it is his duty to inform management if control is not maintained. If expediency suggests the delegation of the function of industrial hygiene to another department, the doctor should have a directional relationship and the reports should be submitted to him.

When I say expediency, I am speaking particularly of plant size. A plant may not be large enough or its requirements sufficient to justify the employment of a full-time hygienist. In that case, it is quite all right for the doctor to arrange for the part-time service of someone out of the engineering department or the chemical laboratory. Certainly such a one should be trained for the purpose. A preferable alternative is the employment of a consulting hygienist who will come in on request or for stated periods. If a consulting service of this nature is provided, it should have continuity. One study may be enough for correction of original harmful conditions but repeated studies are essential to maintenance of control.

I want to say a word about the safety engineer. He is often interested in the industrial hygiene program and frequently quite competent in recognizing conditions that might affect health and in devising methods or means for their correction. Occasionally he is completely responsible for the removal of air contaminants, and this function he carries on in relation to his regular accident prevention program. At any rate, the safety engineer is thoroughly familiar with plant conditions and can be a valuable aid to the doctor in the furtherance of his industrial hygiene program. As a matter of fact, the hygiene program and the accident prevention program have many features in common.

IN THE light of the foregoing, let us now consider some particular exposure and the measures necessary to protect workmen against it, say lead in the form of dust. The portal of entry is the respiratory tract. The obvious means of protecting the workmen is to capture the dust at its source. In any event, the exclusion or removal of lead from the workroom air is essential. This may not be as simple as it sounds. Certain manufacturing processes cause considerable lead dust. To remove it completely at its source is not always feasible, at times impossible, and to effect substitutions eliminating the exposure may be impracticable.

This brings up the question, is it permissible to allow some lead to remain in the air? It is—providing the amount does not exceed 1.5 mg. per 10 cubic meters of air, which represent approximately the amount of air a workman breathes in a working day and the amount of lead he might absorb with safety in a day. Incidentally, this limit applies only to lead oxide dust, but in the absence of accurate conclusions as to metallic lead and lead in other forms, it may be used as a tentative standard for all forms. As a matter of fact, lead in metallic form is easily oxidized, and it is quite possible that other forms are oxidized, either before or after inhalation so that 1.5 mg. may be regarded as practical.

If, because of the nature of a certain operation, lead dust cannot be held down to this threshold limit, that operation should be segregated and the workmen given suitable respiratory protective equipment, such as positive pressure helmets or approved respirators. It is well that all workers in lead, regardless of the extent of the exposure, be examined as often as necessary to guarantee them against toxic effects. Let us consider the control procedures in more detail.

We will assume that the operation under discussion is a soldering job. The solder is used to fill in the crevice of a welded joint in a metallic surface which must be smooth. The solder is melted down and applied to the joint, and the excess is ground off.

We are looking at this job now from the standpoint of the doctor and his industrial hygiene responsibility. He sees three possible inherent lead exposures—fumes and oxides from the pots,

fumes from application of the solder to the joints (the solder is kept plastic by a torch), and dust from grinding off the excess after the solder has hardened.

The doctor wants to know the extent of these exposures and their probability of causing disease. His whole medical program with respect to the workmen involved depends upon that information. Casual observation will not give it. He sees that the pots are hooded, but he does not know how effective the hoods are. He suspects that the torches do not heat the solder enough to volatilize the lead, but he is not certain. He observes some dust on the grinding job. It probably comes from the excess solder, but he does not know whether it is in toxic quantities.

He obtains an industrial hygiene study. The report shows results at the breathing level of the various workmen. With the exception of the men on grinding, the results all show less than 1.5 mg. of lead per 10 cubic meters of air. The doctor thereupon knows with certainty that the problem is limited to the grinders and he can proceed assuredly with his plans to protect them.

1. ELIMINATE LEAD. Obviously the best way to control an exposure is to eliminate the toxic substance. This is neither a medical nor an industrial hygiene problem. On the contrary, it is entirely a problem of engineering.

In this particular instance, the doctor will be informed by the engineer that elimination of the lead has been considered, and without specifying reasons in detail, was not found to be feasible or practical. Then the doctor inquires if the process can be changed so that there will be less dust.

2. PREVENT FORMATION OF DUST. That has been considered and there has been some experimenting. As a matter of fact, coarse files have been used—too slow and expensive, and special cutting tools have been designed—not quite satisfactory. The best way to do the job is by grinding, and that causes dust.

3. REMOVAL OF DUST AT SOURCE. Recognizing the importance of the hygienist's findings and the validity of the doctor's interest in getting control of the situation, the engineer admits the desirability of capturing the dust at its source. For that purpose he installs some exhaust ventilation. The hygienist again tests and finds that there is still more than 1.5 mg. per 10 cubic meters of air. It is not possible to effect further control by ordinary ventilation methods.

4. SEGREGATE UNCONTROLLABLE DUST. "There is only one thing to do," says the engineer. "We'll enclose that job and confine the dust to protect nearby workmen. Then we'll give those who have to work in the dusty area positive pressure hoods."

5. FURNISH PERSONAL PROTECTION BY RESPIRATORS. Certainly men who work in a segregated dusty area must have suitable personal respiratory protection, the most satisfactory type of which seems to be the positive pressure hood. In connection with these hoods, the physician wants to know if the air which the men are receiving is pure. Cases have occurred in which carbon monoxide and other air contaminants have been brought in from the outside. The industrial hygienist obtains this information for him. The changes suggested by the engineer are made. The hygienist checks on them and his findings are satisfactory.

6. RESPONSIBILITY OF THE WORKMEN THEMSELVES. Exhaust systems and respiratory protective devices must be used properly and, being mechanical in nature, they may get out of order—plant conditions may be changed. It is, therefore, essential that the workmen receive suitable instruction and that both the workmen and the protective equipment have watchful supervision. To this end, it is quite essential that the doctor and the hygienist make periodical inspections of all exposures. These should be supplemented by dust counts or chemical analyses when control is in doubt. Although the principal portal of intoxication is the respiratory tract, it is desirable that workmen be taught the facts as to other possible portals of entry in order that they may appreciate the importance of personal cleanliness. Workmen should be completely informed and thoroughly admonished as to their own responsibilities in avoiding lead absorption.

The doctor may now feel reasonably certain that the exposure is under control, but he must not assume that control will always be maintained. He is still responsible for the health of the men on that job, so he examines them as often as he deems necessary for their full protection.

7. PHYSICAL EXAMINATIONS. In the first place, certain physical types are more susceptible than others. The doctor must use care in selecting workmen for such occupations, and he is justified in excluding or transferring any who manifest susceptibility. This applies particularly to workmen who have diseases of the nervous, vascular, ailmentary, and excretory systems. All new employees exposed to lead dust, regardless of the extent of the exposure, should be examined every 30 days during employment. This period may be varied somewhat according to the judgment of the physician and the extent of the exposures as determined by analyses of the lead content of the air. If necessary, the physician should supplement the physical examinations by special blood studies —as a matter of fact, I think that should be routine.

8. TRANSFERS. Periodical examinations make it possible for the physician to recognize evidences of absorption which may have reached a stage justifying transfer to lead-free work. Those who have been transferred should be examined from time to time until found sufficiently free for restoration to original work. Incidentally, if it becomes necessary to transfer a workman, the exposure may have gotten out of control. The doctor's judgment in the matter should be supplemented by industrial hygiene tests of the operation itself.

The foregoing has been described in detail because it is rather typical of the procedure essen-

tial to obtaining control over occupational disease exposures. I hope I have made it clear that industrial hygiene, though immensely desirable and essential to accuracy in reaching conclusions, is but a part of that procedure. I hope I have made it clear that the doctor is in such a position of responsibility that he must act as the coordinating agent. In so doing, he is meeting my conception of his responsibility in industrial hygiene.

Discussion:

DR. J. J. PRENDERGAST (Medical Director, Chrysler Corporation, Detroit): I think Dr. Selby has covered his topic very well. It was a fine paper and there is not much I can add to it. I would, however, like to say one word about the use of the respirator. I don't think the respirator should be used except when vitally necessary and when all other methods that could be used to control the situation have been put into force. The respirator is uncomfortable; it is difficult to force the employee to use it during the complete eight-hour shift. The coming of the positive pressure hood has done a lot to sell the other types of respirators when indicated to the employee, but even with the positive pressure hood we always have the old bugbear of maintenance and of proper application. It is difficult to make a man maintain his hood properly and to take the personal responsibility that every workman should have, and should be educated to have, in himself.

The physician should be slow to relinquish his interest in industrial hygiene. It is an entirely new field to the general practitioner, and the occupational disease laws have received such tremendous publicity in the last few years that the medical profession is fast becoming aware of the fact that they should know more about this problem. I think that in a few years you will see considerable more interest demonstrated on the part of the general profession.

Part-time workers in this field of industrial hygiene are far from satisfactory. It must be recognized, however, that smaller plants must utilize this type of service, because, as Dr. Selby so aptly pointed out, the maintenance of control is the really important factor in prevention of occupational diseases.

It is all very well to put thousands of dollars of equipment into a plant. But if you let the maintenance and control stop, you might as well have never spent the money. I think the problem boils itself down to plant education, because plant managements are becoming aware—are already aware—of that fact. Indeed, you will find the plant managers at times far ahead even of the engineers on this subject.

Night Hazards of Driving

HART E. FISHER, M.D., F.A.C.S.,
Chief Surgeon,
Chicago Rapid Transit Company

YOU who are present at this meeting of the American Association of Industrial Physicians and Surgeons are affiliated with industry, serving the industrial groups in your respective communities—as medical directors in preventive medicine, and perhaps also as surgeons in traumatic surgery. Likewise, there are present many industrial safety engineers. It is fitting that the medical men and the engineers should find here a common ground of understanding in the work of accident prevention, as well as in the prevention of diseases.

You, from the nature of your industrial affiliations, are well aware of the reduction of accident frequency and severity rates that has been accomplished in industry during the past 25 years. How has this reduction been accomplished? Moving machinery has had safety guards placed on exposed parts that are liable to cause injury. Safety rules covering work operations have been put into effect. Mass education in accident prevention has made the employee safety-conscious. Disciplinary regulations have been a factor in reducing unsafe work practices. And the fact has been made clear that in industry the employee's income for himself and family becomes jeopardized in the event that he willfully precipitates an accident.

The better to approach the subject of "Night Hazards in Motor Vehicle Operation" it may be well to compare the industrial employee, whose work is confined to transportation, be it motor coach, truck, or company-owned vehicle, with the individual motorist who operates his own car, either in business or for his personal convenience or pleasure.

The fleet driver is under industrial supervision, regulation and discipline, and so he is alert to the hazards of the street and highway, conducting himself in an orderly and safe manner. But the individual motorist is solely upon his own, and he conducts himself when behind the wheel in direct proportion to his ability to visualize accident possibilities before they arise and to exert self-discipline in his daily actions.

What do we mean by accident visualization? Simply that many persons lack the ability to foresee the possibility of conditions and circumstances that are potential accident causative factors. It is common knowledge that many persons driving motor vehicles have limited mental capacity and are, therefore, unable to foresee or mentally formulate and recognize conditions liable to produce accidents.

The second factor productive of accident is the lack of self-discipline, which is simply the lack of rules governing the individual's moral conduct. If he lacks the ability to discipline his actions and violates traffic rules and regulations willingly, then you have the traffic offender who is the menace on our streets and highways. Some people, and they are not confined to any particular class or group, think "stop" signs, speed limit markers and other designated warning signs are for the other fellow. If these people can violate them without getting caught they feel a thrill or have a sense of exaltation.

IF WE have these unsafe factors in individual motorists in the daytime when visibility is good, what can we expect from such selfish people in safe conduct at night when darkness descends and the possibility of being checked by our traffic and highway police is very small?

I believe that question is answered by the known fact that 60% of the fatal accidents occur at night when but 25% of the daytime traffic is upon the streets and highways.

To illustrate the hazards of night driving it might be well to describe some of the personal factors in the motorist that unfit him or her to *safely* operate a vehicle at night.

Acuity of Vision: Many motorists driving cars have a defect of vision of one kind or another, and hence they are unable to see at night as well as during the day. With normal vision the range of sight is confined practically to the beams of the headlight, and then only at distances in proportion to the candlepower of the headlight bulbs, the proper focusing of the beams, the condition of cleanliness of the headlight glass and reflector, and, finally, whether both lights are functioning. In addition to the factors just enumerated, vision depends upon the cleanliness condition of the windshields. Rain, fog and snow further obstruct the range of vision, whether the motorist is normal or defective in his ocular mechanism.

The fields of vision of a motorist, therefore, which are normal in the daylight, are narrowed with the onset of darkness to the beams of his headlights. Very little peripheral vision is present. The countryside beyond the edge of the pavement is usually a blank. The limitation of these fields makes it well-nigh impossible to see objects coming from the side of the road.

There are a considerable number of persons driving motor cars who have narrowed fields of vision unknown to themselves. In our personal experience we have observed such drivers constantly turning their heads from side to side in the effort to bring into the range of these narrowed fields objects approaching from the side.

Stereopsis (lack of binocular vision), with the inability to estimate depth, distance, or speed of moving objects, is another frequent unknown condition more or less prevalent in motor vehicle drivers. One has but to recall the many conditions that are apt to be present in the eye that make eyesight less than it should be, or the possible loss of one eye, either through disease or injury, or such things as opacities, cataract, etc., to force realization that monocular vision is not only a hazard in the daytime, but is thus multiplied many times over as to its dangers in night driving.

Then there is night blindness or the delayed regeneration of the visual purple in the retina of the eye. The adaptation to darkness after the passing of a glaring light requires probably many seconds, and in some cases many minutes. During this interval between glare adaptation and dark adaptation a motorist with such a defect is driving practically blind, and so it is at this time and from this cause that accident incidence is high.

If traffic were such that glaring headlights of cars came into sight only at long intervals, this slow regeneration of the visual purple might not be hazardous. But under traffic conditions as they are found on our main arterial highways at night, the passing of glaring headlights is so frequent that they hit the eyes with almost machine-gun rapidity. When the first one passes the iris is compelled to contract for the glare, and before dark adaptation is complete (regeneration of the visual retinal purple) we have subsequent rapid contractions and dilations in proportion to the number and frequency of the subsequent passing cars. After a time, then, the iris becomes fatigued, replacement of the visual purple is slow, we have a dysfunction of our sight, and objects become blurred or rubbed out altogether.

Much excellent research has been done and is being done relative to night blindness—especially with reference to those persons in whom a deficiency of vitamin A is related to a slow regeneration of the visual purple. This particular subject has attracted a number of research investigators. The reports of these scientists have revealed the improvement and return to within normal limits of dark adaptation when vitamin A is given in successive doses and vitamin A forming foods are taken by the patient.

Personally, however, we do not believe that the hazard lies wholly in the number of persons having night blindness. Their condition, it is true, causes night motor accidents. But accidents have occurred where the persons involved had normal regeneration of the visual purple. The dazzling glare so blinded the driver that the accident resulted before the glare had passed. Further investigation on larger groups of adult motorists will, no doubt, give the answer, in total, as well as in these several respects.

FATIGUE of ocular muscles, due to their constant work in concentrating upon the driving of a motor vehicle, is a fact taken for granted by all of us who after driving for long periods have experienced the feeling of tired, aching eyes. Likewise, we are aware this fatigue is greater at night, even with less mileage covered. Under ocular fatigue more nerve energy is used up, hence the irritable disposition manifested by those long on the road, and the headaches, and the congestion present in our ocular sclera.

Color blindness, too, plays a greater part in accident causation than has been given it by safety engineers and physicians. Persons so afflicted have difficulty in the proper interpretation of the stop and go traffic lights. Some color-blind persons depend upon the flow of traffic ahead, conducting themselves accordingly. They stop when the cars ahead stop, and go with the crowd. Then again these color-blind persons learn the position of the different colored glass, red on top, amber in the middle and green below, or vice versa. Then when they see the upper glass illuminated they associate danger. This method might be all right if all traffic lights were of the same design and the posi-

tions of the various colored glasses uniform. But since that is not the case, sooner or later the color-blind motorists get into trouble — usually when there are but few cars on the street, or in an unfamiliar community.

THE focal point of a motorist's vision increases in proportion to the speed of the vehicle. At moderate speed, 40 miles per hour, the focal point is about 1250 feet, while at speeds above 60 miles an hour the driver's focal point is about on the horizon before him. The intervening space between the point on which the driver's vision is concentrated and the vehicle itself is blurred, and details of the road surface, etc., are lost. The only way one can see the road surface ahead of the car is by accommodation from the far point to the near point, with the result that, if traveling at high rates of speed, this short interval of accommodation may be just sufficient to bring a hazardous situation into view, but insufficient to permit proper retardation of the forward motion of the vehicle—and an accident results.

At night the driver's focal point is confined to the farthest limit of his headlight beam; but if he doesn't slow down with the onset of twilight, he will over-drive his headlight beam. He can see only as far as his headlights illuminate the road before him, and if he drives at a high rate of speed, an obstacle (a stalled truck, or, perhaps, a horse-drawn vehicle) which lies just beyond the range of illumination, suddenly appears and the rate of speed precludes avoiding it.

Here is where visualization of accident possibilities and self-discipline find themselves involved in the matter of safe driving at night.

IT IS NOT intended in this paper to cover physical hazards of our streets and highways of an engineering nature, but there is one condition that may arise in night driving where lack of knowledge concerning it may be productive of an accident. It is not an engineering problem, but a problem of Nature's own design.

I have personally experienced a hazard on various occasions during my many night hours of driving in fulfilling lecture dates on accident prevention in the past five years. For want of a better name for this hazard, which may very suddenly appear on the road ahead at night, we have dubbed it "fog shadows." "Fog shadows" are met with on nights when the atmosphere is heavy with water vapor. The highway ahead may be clear in the headlight beam, when all of a sudden there appears a cloud of fog, which in the reflected light of the headlights assumes the definite shape of an obstacle the nature of which is startling in its sudden appearance. At moderate speeds these startling "fog shadows" would be no real hazard, but at high speeds, with the driver's attention diverted from the road ahead to something that, without warning, looms up as an obstruction, the quick attempt at rapid retardation of the car might precipitate an accident. We firmly believe that these "fog shadows," simulating obstacles as they do, might be the explanation of many of the unexplained fatal accidents at night which have occurred where no other solutions were reasonable except that the driver must have fallen asleep.

Probably the explanation of this "fog shadow" is that the curtain of fog or water vapor, which may not be of any great depth, holds in suspension enough moisture droplets to act as a sort of picture screen, so that, when it reflects the beams from the headlight, "fog patterns" appear which, on sudden view, assume the shape of an obstacle ahead. The solution of the problem presented by these "fog shadows" is to drive at a speed at which reasonably quick and completely safe stopping of the vehicle is possible.

IS THERE a solution for these hazards of night driving that will result in a reduction of the fatality rate? Our sincere belief is that the remedy lies in the education of the motorist, to make him fully aware of his physical limitations to meet the hazards of night driving. The proper education will inculcate in him the fundamentals of safe motor vehicle operation, and make him appreciate the responsibility entrusted to him when he is behind the wheel of a motor vehicle. Each individual believes himself a driver equally capable, if not superior, to his fellow man.

One forceful means toward this education is more stringent traffic laws, especially those governing the minor traffic conditions, such as stopping at intersections, waiting for the complete change to the green light, and avoiding forward movement on the amber light. Enforcement of all traffic laws, by municipal and state highway traffic officers, will also be of great value.

We are blessed with a very extensive and splendid highway system which has been improved in phases of design and construction as needs have required and performance has warranted. Many of our arterial arteries are reasonably safe when individual caution and self-discipline are exerted by the motorist. With day driving so much less hazardous than night driving — even though at night there is only one-fourth to one-half of day traffic, those streets and highways showing the highest accident frequency at night would experience a marked reduction in accidents if day visibility were brought to night driving through the medium of street and highway illumination by the use of the efficient sodium vapor electric light. Highways that have sodium vapor installations have already shown a marked reduction in motor vehicle accidents.

THE American Association of Industrial Physicians and Surgeons, by reason of its members' knowledge of and close relationship to the accident prevention work in their respective industries, can be a vital force and of inestimable value in cooperation with the safety engineers, in helping to bring about a safety consciousness on the part of industrial employees in motor vehicle operation in general. It is a well-known fact that many employees who conduct themselves safely at their jobs, upon the completion of their day's work, leave, so to speak, their safety clothes, and when

they get behind the steering wheel of their own motor cars, conduct themselves in a manner that makes for accident causation. Aid your industrial safety engineer in educating the employee as to his mental and physical limitations in motor vehicle operation. Were all the large industries represented here to attempt a general plan of accident prevention in their employees' personal motor vehicle driving, a large percentage of our citizenry would receive educational training and information they now lack.

This subject is of such vital importance to the virility of our nation that we believe that our Association, which is gathered here today in convention, could well afford to have a committee appointed to study the problem and devise ways and means of carrying it on through our membership and their respective industrial affiliations. In these hectic days of attempts at regimentation of the medical profession, with the spectre of state medicine confronting us, such an humanitarian effort on our part would not only merit improved public relations, but also would set an example for other like organizations to emulate.

In closing, permit my repetition of the basic factors of motor vehicle accidents:—the too general lack of power of visualization of accident possibilities, and such a lack of self-discipline on the part of automobile drivers in general as inhibits their conducting themselves in a safe manner and in a spirit of true sportsmanship when behind the wheel.

This latter quality is sadly lacking in many of our present day relationships, but its lack in automobile driving is one definite cause of too many automobile accidents.

Factors Determining Reasonable and Equitable Temporary Total Disability Periods

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In an endeavor to bring about a more accurate estimation of disability periods resulting from injury, certain essential elements must be taken into consideration. A competent clinical history, citing the nature of the accident, the force applied in the production of the injury, and the immediate post-traumatic sequence of events, must be given primary consideration. It is important to know just how the accident occurred. Was the force a mild one, or was it sufficient to injure important subcutaneous structures, or was it sufficiently severe to produce fractures? These are some of the questions. Again, was the worker immediately incapacitated? Was the injury compound? Was there mild or profound shock following it? These are some other questions which the surgeon must determine.

When once a definite clinical picture is in mind, a physical examination is undertaken. This examination includes laboratory tests and x-ray examinations as well as careful physical examination of the extremity or extremities involved.

Such examinations are valuable only when they are unbiased and not influenced by any relationship with the patient. Preconceived ideas as to the patient's disability will lead to many errors. We know that during the examinations patients will often try to misrepresent or to exaggerate symptoms. Too frequently one is inclined at once to stamp the patient as a malingerer. We must always remember that biased or prejudiced estimates are bad for the worker, the examiner and the corporation. Such a report, whether written or given orally on the witness stand, loses its value. Industry expects a surgeon to be fair, and I think he can be unbiased if he places himself in the position of the injured man in estimating disability.

Since my subject deals with temporary total disability, it is necessary that we have a clear understanding as to what the term implies. To me it is that period which elapses between the time of the injury and the date of maximum improvement of the damaged extremity irrespective of the type and extent of treatment rendered during this period. It may be temporary total disability of finger, toe, leg or arm, or of the whole human mechanism. When improvement has reached that point which will permit the patient to follow a gainful occupation, then, of course, the temporary total has ceased. After this period, improvement in circulation and in joint movements may still take place.

This period of time varies in given injuries depending on the tissues involved and the severity of the damage. Again, it varies in the individual cases depending upon the patient's general health, his desire to get back to work, his cooperation with his physician and his mental attitude toward injury, compensation and industry.

There are other factors which enter into the estimation of temporary total disability. Such are:

1. Hemorrhage into the tissues or loss of substance of skin, fascia, muscle and bone.
2. Infection, either of the skin, soft structures, bone or joints.
3. Disability resulting from a previous injury.
4. Arthritis and other chronic infections.

5. Medical and surgical procedures applied in a given case.

6. Method and extent of rehabilitation efforts made by the surgeon.

Only roughly can one estimate how rapidly skin, soft structures, nerves and bones will heal, or when normal circulation will be restored. This applies to those cases that we see early. Only by very thorough examination and proper evaluation of the findings can the surgeon state that the structures have reached a point of rehabilitation where no further improvement may be expected. In estimating disability, and especially when making an effort to determine whether temporary total disability has ceased, the surgeon must depend on his own clinical experience. The patient's story as to what duties he can perform and what movements he can make is, in 95% of the cases, not "worth a dime." When examining for a specific determination, inspection, palpation and even percussion and auscultation must be utilized. One must analyze in his own way the condition of structures at the time of injury and their present state of repair. This requires "honest imagination," if you know what I mean. After viewing the extremity as a whole, then one must go into detail in order to determine the condition of the various structures involved in a given injury. One by one the various structures must be examined and their present state of repair evaluated.

When examining the skin, its color and consistency should be noted. Is there any thermal disturbance? Are there calluses? Is the sensation normal or is there anesthesia or hyperesthesia? All of these questions must be answered in the mind of the examiner. When scars are present, he must determine whether they are recent or old scars, remembering that the fresh scar is red whereas an old one is usually white. Is a scar adherent to the underlying tissue? Is it painful to the touch? Are there such contractures which may bring about loss of extension or flexion of the extremity? Is the skin completely healed?

Next comes the examination of the underlying structures, the fascia and muscles. Loss of fascia, adherence of fascia to muscles, contracture of fascial planes—all of these must be determined. Is there loss of muscle substance, or is there scar formation in the muscle belly, or has there been hemorrhage into the muscle? Such loss of muscle tissue and scar formation leads to a lowering of the threshold of fatigue in an extremity, and this must not be forgotten when we make our estimation.

In examining a joint, one must determine the condition of the joint capsule, contractures of the capsular ligaments and the stability of the joint itself. Tendon and tendon sheaths are examined. Are they adherent, absent, or partially destroyed by trauma or infection? Is the action of the tendon free in its sheath both in active and passive motion? Is there atrophy of the tendon from injury, infection or disuse?

Injury to the arteries and veins must be carefully evaluated. Loss of blood supply to the part will bring about disability many times in the absence of scars in the skin or subcutaneous structures and of course with negative x-rays. It is necessary to determine whether the blood vessel disturbance is due to injury or disease, remembering at all times that a patient with thrombo-angiitis obliterans, or Buerger's disease, does not endure trauma. When there is any doubt about the arterial blood supply, the thermocouple, or, still better, the oscillometer, will be of material aid. I have seen many cases of injury of the lower extremity where there was absence of the dorsalis pedis artery, but the oscillometric reading was within the normal range.

Examination of the bones of the extremities or torso can be made by palpation in many instances where the bones lie superficially. X-rays are our final aid, determining not only the type and extent of fractures but also the formation of provisional and permanent callus, and x-ray films should be our last court of appeal when determining that a bone has completely healed. Such information gained from the examination of the films must be corroborated by clinical evidence of stability and healing. It is not necessary for me to remind this audience of the value of a two-plane film or a stereoscopic examination, the stereoscopic being of special value in fractures of skull, spine and pelvis.

In estimating disability following fractures there are several very important points. First of all, is there bony or fibrous union? Is there perfect alignment? This is especially important in weight-bearing bones. Is there any shortening of the extremity from loss of bone substance or from overriding?

Armed with all of this information and after one has shown that he has taken all of this into consideration in his examination and estimation, one need have little fear of "cross examination."

Some examiners make much of the measurement of the circumference of the extremity. This, in my opinion, is so very variable that it has little value. Other men attempt to estimate disability from the amount of motion which the patient is able to produce in the joints. Here again the personal equation is so great that it is difficult to determine how nearly normal the movements are. In some clinics measurements are made of the strength of the muscles. When these tests are made under electric stimulation which is measured or graduated, they may have some value; but when we depend upon the ordinary dynamometer, such a measure of strength is deceiving because the patient, even though he pretends to use great force and presents marked facial grimaces, may not be exerting any force at all.

IN determining the temporary total disability, one must not fail to take into consideration the patient's general health and the existence of other conditions or dyscrasias such as arthritis, the anemias, etc. We know that patients so afflicted not only are more easily injured but recover slowly from their injuries, and it takes fine judgment to evaluate pain resulting from the injury and that existing because of arthritic changes.

No one should make an estimate of temporary total disability or its termination until he knows just what operative procedures have been carried on and what rehabilitation methods have been used.

It is a well known fact that in nerve injuries the untreated cases may be improved even after many months, and that under proper management improvement of motion, sensation or muscle atrophy may be noted as long as 18 months to two years after the accident. It is therefore necessary that all of these methods and especially the rehabilitation work which has been done be taken into consideration.

I have some very definite convictions along this line. It is my belief that we have too much humbug and hocus-pocus in the treatment of industrial cases, and that we have too much worthless physical therapy glassware and equipment. We have too much of "infra-violet" and "ultra-red" and I use these terms advisedly; too many switches which can be turned on without physical or mental effort; too many indifferent, incompetent and lazy medical men to whom the management of these cases becomes so stereotyped and so routine that the use of cortical cells becomes unnecessary. I have in mind at this time a case of fracture of the small bones of the hand who had 34 physical therapy treatments in 30 days. I cite also the case of a worker who gave his own physical therapy treatments.

I am convinced that there is no standard method nor yardstick by which temporary total disability can be prognosticated or estimated. The various factors which I mentioned and the personal equation must be taken into consideration at all times. Time does not permit me to discuss in detail these various factors which I have enumerated, and I think that before a group of this character this should not be necessary. I believe that if we use a little common horse sense and a little God-given psychology, we should be able, as far as it is humanly possible, to determine reasonably and equitably for every one concerned temporary total disability periods.

IN CONCLUSION I make a plea for more competent doctors in industry; men who have put forth a sufficient number of units of energy to prepare themselves for this very important work. I plead for more honest doctors in industry; men who will call the strikes as they honestly see them; men who will not perjure their souls for a five-dollar bill—nor for 20 times that amount; men with the courage of their convictions and the backbone to be honest.

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Discussion:

DR. VOLNEY S. CHENEY: As he usually does, Dr. Kreuscher covered his subject so thoroughly that there isn't very much that can be added by way of discussion. And so I can't do much more than say that I am thoroughly in accord with all he said. But there was a thought that came to me as he was talking: it is that we have to take into consideration the mental attitude of the patient, the attitude that has been developed during the course of his treatment.

I have had the experience, and I know you all have had it, where a very trivial injury has brought about a neurosis, or a thought in the mind of the employee that he has a serious injury or one that is liable to become serious. The doctor may have discussed the man's condition in his presence, and he grasps a word here and a word there, and these have left the impression with him that it is serious. Indeed, the very fact that he is being discussed impresses him with a feeling of seriousness. We find these cases frequently where a patient has received first aid in a department and has gone to an outside doctor or to his family doctor. The family doctor has increased the man's anxiety and has built up a foundation for this mental impression.

That brings on a condition we have to treat after the injury. There has been full recovery from the injury, but this mental impression has to be removed and, as you know, it is not always easy to remove it.

I think it is a very good practice—we have made it our practice—that the patient's condition be not discussed at all in his presence. We do not look at the x-rays in his presence. In fact, we tell him as little about it as possible, except that we try to assure him that everything is going to be all right. If we have any question we want to discuss with our associates, that is done in private.

I would like to mention this thought, too. We haven't really a standard for the determination of disabilities. Nearly every man in industrial work has his own standard. Efforts have been made by several men—Kessler, in New Jersey, and McBride, in Oklahoma—to standardize the examinations for permanent and partial disability. I agree that Dr. Kreuscher's paper might be the beginning now of a gathering together of the various methods and the correlating of them, so that they can be distributed to our membership in the form of a brochure which will assist them in making these determinations.

DR. DAVID STRAUS (Medical Director, Illinois Industrial Commission): There are two points I would like to bring out: The one has to do with having the patient's cooperation in the after-treatment and during care. To get into physical therapy early, of course, is very important, and what Dr. Kreuscher had to say about the various lights, that they are worth very little, I think is true. The essential thing to be gained, as soon as possible, is the patient's cooperation in the physical therapy which means trying to begin motion as soon as he can, and encouraging him to do it himself. Surely voluntary motion is much more valuable than passible motion done by somebody else. I think in postoperative care, or even if there is no operation, it is important to have the patient himself do his own physical therapy as early as possible. I believe that is usually quite early, earlier than most people appreciate.

The other point I want to stress is in regard to the standards for total partial or total permanent disability, that is, partial or complete total. When I began my work with the Labor Department here in the state, I was very much interested to find out if the army had any standards of that kind. I went over to the Corps Surgeon's office in this area. I might say that I was on the Disability Board in France, in an evacuation hospital in 1921, and I have some idea of what malingering is like. Over there, after the Armistice, everybody wanted to go home. I happened to be president of the disability board of a hospital of a thousand men. If they had flat feet, they said they hurt

them; and scars were painful—not to mention bed-wetting, of course, which does not have any disability features you can do anything about.

It is a clinical problem to try to be fair to the person and to the organization to determine surely whether a man is injured or not. I think it requires a good deal of care and study, and a person must be indifferent and not even listen to what the men have to say.

To make a long story short, and conclude my remarks, the surgeon at the army headquarters looked around, but he was unable to find any yardstick that the Government has to determine disability—which, of course, in the army is the same as in industry.

It comes down to the fact, as Dr. Kreuscher so properly stated, that in each case it is up to the man to make the determination. There isn't any yardstick, and I don't think there ever will be except the yardstick of: "What can that man do." And not only that, but also: "What will he do?" In other words, you have to subtract the one from the other and come to the answer as to what is his real disability.

So I don't think we can ever formulate disability so you can put it on paper, because each case is a law in itself. But I do think that the patient, himself, should make the effort, at least to do his own physical therapy.

DR. EDWARD C. HOLMBLAD: There are three little items I want to leave with you.

I would like to draw a parallel between the judgment of the man who appraises temporary disability periods and permanent, if you like, and the judgment exercised by the experienced industrial physician and surgeon in comparison to that exercised by the surgeon. We feel the one thing that age and experience give a surgeon is that intangible thing we call "surgical judgment." We have the similar thing to gain by experience in industrial medicine and surgery, and when we have gained it, we will have obtained the proper and the broad viewpoint of all these many factors that have to do with temporary total disability. When a man can sum those all up in one picture and render a judgment on the problem they present, then I think he will have gained the proper judgment as to the reasonableness of the temporary total disability period.

I want to mention, also, an extraneous factor in connection with the termination of the total disability period, you then have an excellent method of terminating the and that is the attitude of the employer. If the employer will give the man the lightest and easiest kind of work, period. On the other hand, if he is not going to take the man back at all, you have a different problem to deal with. Those factors modify it to some extent.

And third, and last: I was glad to hear Dr. Kreuscher talk about the lamp treatments. There is no question but that they are the bane of industrial surgery. That is why it is so important, when you appraise a case of two or three months, to find out what kind of treatment it has had—lamp or conscientious rehabilitative therapy. Don't forget that the best rehabilitation we have is natural, honest-to-goodness work, coupled wtih a genuine desire to get well.

DR. FENWICK (Valparaiso): I wonder what he writes on his insurance blank or compensation insurance duplicate in answer to the question of total disability, as to the time involved?

DR. KREUSCHER: At the time of our first examination, our men will make an estimate which is sufficiently wide in number of weeks or months so that our claim department will know just about when the patient should be well. But in our own minds, of course, we reserve certain things, and those things are: Is the patient going to have an infection? Is he going to heal as ordinary people heal? Is he going to have a non-union? Has he had a greater hemorrhage from the injury than we thought he had?

There isn't any one thing you can put on a blank, except as a guess. And everybody knows it is a guess—a reasonable guess. It is an honest guess, and that is all we can do.

DR. LLOYD NOLAND: One thing I would like to emphasize, which I think becomes the crux of the whole matter, is that the employee feels that the industrial injury is being handled by the surgeon representing the employer. We all realize that the attitude of the average individual is that the surgeon representing the employer is going to minimize the amount of his damage, if he can. That is the first thought.

I believe that if every industrial surgeon will take the trouble to study his patient, his patient's psychology as much as his injury, he will make the man feel that he will get the benefit of any doubt in the matter. By dealing with the patient in perfect honesty I think we can keep more troubles from cropping out than any other way; in other words, a constant attempt to impress the individual that the surgeon is absolutely honest and that he has his welfare at heart as much as he has the saving of money for the employer.

The Acute Abdomen

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A GOOD many years back I wrote an article under the title of "The Acute Abdomen." At that time my work was entirely surgical and experience indicated that many physicians were most casual in treating abdominal symptoms. As a result of this many unnecessary deaths occurred and if not death, surgical procedures were complicated by serious pathological processes causing long periods of disability and much post-operative morbidity.

Since I have been in industrial medicine, having under my supervision a potential group of 10,000 individuals in the Wall Street community, I have been impressed by the fact that in spite of every diagnostic facility at hand we must be alert to avoid error in this regard. Here our patients are seen very early, in most cases at the onset of symptoms. We do not have the opportunity to observe them except for a very short time and in spite of the group of physicians trained in and associated with the best hospitals in New York City, men who are mindful of the importance of correct early diagnosis, it requires all of our diagnostic acumen to avoid the pitfalls which still trap the best of diagnosticians. Only our hard and fast routine to consider all such cases surgical until proved otherwise, sending them immediately with careful instructions and full laboratory data to their personal physicians or to hospitals, helps us to avoid the embarrassment of error. Hardly a week passes but that we are confronted in this clinic by symptoms of abdominal disease.

While I am fully aware that I have nothing new or unknown to offer, it is a fact today, as it was two decades ago, that physicians in practice still fail to treat abdominal symptoms always with the respect they deserve, and my object in writing this paper is to refresh your minds and remind you of the seriousness of casual management of the ab-

dominal patient. It does us all good to have a "jog" on all problems now and then, for we are at least apt to be more alert for a while after such a reminder.

The great variety of pathology in acute abdominal disease and the indefiniteness and similarity of symptoms, especially at the onset, makes this one of the most important problems for the practicing doctor. In addition to the seriousness of mistake for the patient, the news spreads rapidly and may bring about undesirable gossip and harmful criticism to the doctor or the clinic. Who has not felt the chagrin of treating a gastro-intestinal upset as acute diarrhea to have it end in an acute appendix, the diagnosis being made by the second doctor.

I have heard it said that a leukocytosis will always differentiate acute surgical pathology from a simple diarrhea. My experience has proved that this is in error. It is not at all uncommon to have a very high leukocyte count with simple, non-surgical, acute gastro-intestinal disorders.

A consideration of the pathology teaches us that in a majority of cases of surgical abdomen the acute attack is but the end result of some chronic process. In many cases there is the history of previous attack or of chronic functional disorder, and this is most important in making the diagnosis. This calls to mind, however, what I have said about what we may term the "freak of nature," for often there is an absence of significant history and operation discloses pathology which gives unquestionable evidence of chronic, long-standing pathological change, the acute attack being the first evidence of trouble. All of this adds to the possibility of error in diagnosis.

The end result of the acute surgical abdomen is peritonitis. If treatment is to succeed, therefore, early diagnosis is essential. The first one on the scene has the best chance and assumes the greatest responsibility, for the symptoms and signs are usually localized soon after the onset. Few surgeons see the acute abdomen until after the family doctor has been called. After peritonitis has advanced the picture becomes cloudy. The diagnosis is most difficult and the prognosis most doubtful. It takes a smart surgeon indeed to make a diagnosis when this stage is reached. When peritonitis has become general or diffuse the primary lesion ceases to be the chief factor. The patient must now overcome the peritonitis to recover. It is dangerous ground to delay surgery under such conditions. It is my impression that the acute abdomen should be operated upon as soon as seen, whether or not localization is evident or has been evident. Be conservative, yes, but operation is the first step of successful treatment.

If a patient gives the history of recovery from an acute abdominal attack without surgical intervention, he should be given a thorough investigation to determine the cause of such an attack, for a second attack may prove fatal. Anyone who neglects to do this assumes tremendous responsibility, and the family doctor has more influence with his patient than an array of consulting talent. Here, again, one cannot afford to be casual.

Every physician should be familiar with living surgical pathology. This can only be seen in the operating room. Whether a doctor does surgery or not, the more he knows about living surgical pathology, the better doctor he is. The operating room is, therefore, important for the physician as well as the surgeon.

ANY classification of the chronic, underlying causes of the acute abdomen must begin with appendicitis for this is, without question, the commonest disease in abdominal pathology and it is likely that often it is the primary cause of other chronic lesions. Following in order of frequency are: duodenal ulcer, gall-bladder disease, hernia, gastric ulcer, tumors, and pancreatitis. In this classification we must also include anomalous formations or defects and abnormal condition of organs from previous operation or disease.

Classified according to lesion the acute abdomen means: appendicitis, cholecystitis, perforated duodenal or gastric ulcer, hernia, acute salpingitis, acute intestinal obstruction, ruptured ectopic pregnancy, twisted pedicle of pelvic tumors, ruptured ovarian cysts, acute diverticulitis, acute pancreatitis and mesentery thrombosis. We must also bear in mind the possibility of abscesses of other abdominal structures. One should always have in mind acute pyelitis, and in the pneumonia season especially remember that acute diaphragmatic pneumonia may in its early stages give signs that suggest the acute abdomen. Needless to say, abdominal operation in the early stage of pneumonia or the acute stage of pyelitis is an operation that may be most serious and embarrassing.

It is not my purpose to attempt a description or differentiation of all the conditions responsible for the acute abdomen, but rather to remind you of some more or less common pitfalls associated with lesions, where error may prove tragic.

Never delay in answering a call to one who has an acute abdominal, upset and do not be misled by the history of dietary indiscretion. This is a common pitfall. Acute appendicitis and perforated ulcer often follow the midnight supper.

I remember a doctor who thought he had indigestion and did not seek help although complaining because he had eaten a bag of peanuts at a ball game three days before. When he did call a doctor a diagnosis of general peritonitis was made and this was confirmed at operation.

Beware of cathartics! Never give such drugs during the acute stage of any abdominal disorder. If in doubt about an acute abdomen, apply palliative measures and call again in six hours and if still in doubt, send for a surgeon or send the patient to a hospital.

ANY patient suddenly seized with acute abdominal symptoms and the presence of an abdominal scar, evidence of previous operation, should arouse suspicion of serious trouble. At once intestinal obstruction should be in the mind of the doctor. It is not necessary to remind you that delayed operation in an intestinal obstruction means death no matter what the cause. Blood count is of no value in this condition. The chief

symptoms are sudden, severe pain, general or localized tenderness, nausea and vomiting, rapid dehydration and a very sick patient. Constipation completes the picture.

The mortality of the acute abdomen increases rapidly after the first 12 hours. Each additional six hours adds an increasing percentage of failure for surgery.

The late John P. Murphy once said: "Somebody has been to blame for every death from acute peritonitis." Early radical treatment in these conditions is conservative treatment. No surgeon has ever been sorry for operating too early but, oh, the regret and sorrow when too late!

One of the confusing lesions of the abdomen is acute diverticulitis of the sigmoid. The signs of this condition are similar to those of acute appendicitis, the localization, however, being in the left lower quadrant. Constipation, flatulency with discomfort when passing gas, and the presence of a localized mass suggest this condition. The passing of gas differentiates it from intestinal obstruction.

A lesion which we see occasionally is a ruptured graafian follicle cyst or other ovarian cysts in unmarried women. The symptoms of this condition are much the same as a ruptured ectopic; sudden, sharp pain accompanied by collapse, but the absence of a mass sometimes confuses one. Local pelvic signs may be misleading. Never let the question of marriage weigh too strongly when seeking a diagnosis.

One condition in acute abdominal disease that stands out above all others in importance of immediate diagnosis is perforated ulcer. A few hours delay here actually means the difference between life and death. If operated on within three hours, recovery is practically assured. After nine hours the mortality is 50% and it increases with every hour thereafter.

Dr. John B. Beaver used to say: "The diagnosis of this condition can be made in the dark by merely placing the hand on the abdomen." The retracted board-like abdomen is characteristic and peculiar to this accident when followed immediately upon a sudden, severe, acute attack of epigastric pain. Usually accompanying this are the signs of shock or the facies of apprehension.

One cannot avoid mentioning appendicitis when discussing the acute abdomen. It is conservative to say that 60% of all acute abdominal attacks are due to appendicitis. There is an old rule: "When in doubt, go for the appendix." Owing to the wide variation of the location of the appendix it is very often confused with other acute conditions. When high it may be confused with gall-bladder disease or ulcer, and when low with pelvic disease. Then too, acute appendicitis does not always follow the rules. Ordinarily acute epigastric pain with nausea or vomiting, followed shortly by lower abdominal pain localizing toward the right lower quadrant accompanied by an increased pulse rate constitute the symptoms of acute appendicitis. Don't be misled by a normal or sub-normal temperature. This is very common. Often nausea and vomiting are absent, sometimes the symptoms are localized in the lower right quadrant at the onset and not infrequently the pain is general and localization indefinite. The blood count may help, but who has not seen a gangrenous appendix with a low blood count and likewise who has not seen a very high blood count with simple diarrhea. At best, the question of the blood count in all acute conditions should only be considered in relation to the physical signs and general condition of the patient. When to operate should not depend on the blood count alone but on the physical signs and symptoms.

The acute traumatic abdomen is always difficult and interesting. Injuries may be penetrating or non-penetrating. In either case, early diagnosis is not always easy. The question whether to operate is often difficult to determine. Pain is not a reliable guide.

Perforated or ruptured organs and hemorrhage are the likely lesions. The general condition of the patient, the character of the pulse and abdominal rigidity furnish the important signs. A rapid pulse of low tension continuing after the first shock suggests hemorrhage. Rigidity and localized tenderness are most suggestive of serious organic injury. Of course, bleeding from any of the organic outlets is significant. It is better if in doubt to operate promptly upon such cases. Delay means failure. No harm can result from exploration. How to proceed on operating upon the acute abdomen and what to do and what not to do are questions to be determined by personal experience, and the degree of success depends very largly on the ability and intuition of the individual surgeon, measured by his knowledge of abdominal pathology and organic physiology.

The primary object of surgery in the acute abdomen is to save life. Every case is an emergency. This is no time for fancy work or extensive attempts to cure underlying pathology. Enterostomy, local repair of ruptured organs, drainage of localized abscesses and ligature of bleeding vessels, going in carefully and getting out quickly and with postoperaitve management consistent with the natural processes at work is masterful surgery and will bring about recovery often in conditions which appear hopeless.

Occupational Disease Symposium

—The Second Annual Symposium of the Department of Industrial Medicine, Northwestern University Medical School—

THE Second Annual Symposium on Occupational Diseases of the Department of Industrial Medicine of the Northwestern University Medical School will be held September 26 and 27, 1938, at Thorne Hall on the Chicago Campus.

The program will include papers on industrial disease education, the scope of the occupational disease research problem, traumatic neurosis, the health of the worker in the shop and at home,

industrial plant surveys, industrial health and the practicing physician, cardiovascular disease, and peripheral vascular disease in the middle-aged group of industrial workers.

At a final evening banquet session the subjects will be the responsibility of labor, management, and the community, and morbidity and mortality statistics. The complete program will be published early in September.

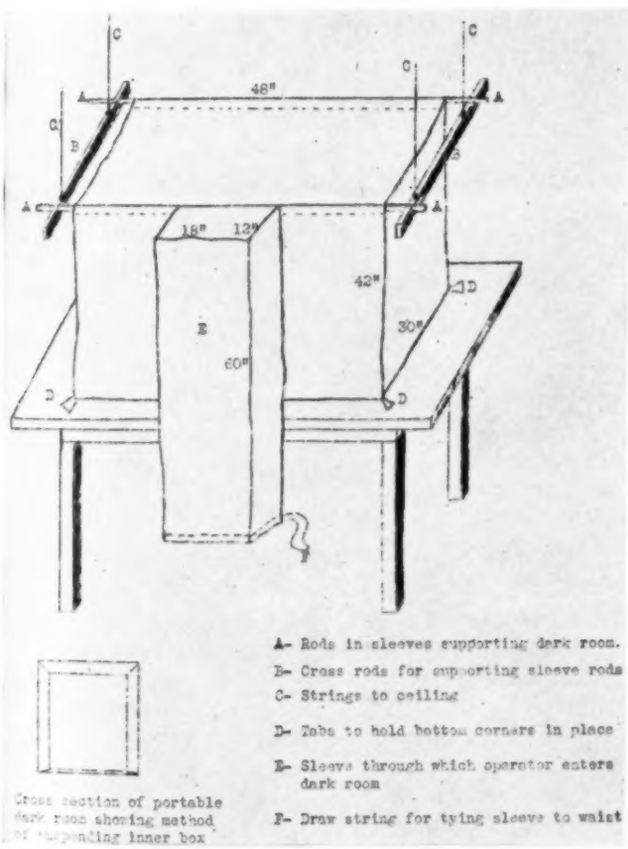
A Portable Dark Room

John F. Cadden, M. D.,
Director, Bureau of Industrial Hygiene, State of West Virginia

THE portable dark room here described was developed for use in field x-ray work.

Essentially it consists of two cloth boxes (heavy black sateen) one within the other, and is suspended over a desk or table, the bottom of the box being supported by the table.

Entrance and exit are accomplished through a



Cross section of portable dark room showing method of suspending inner box

sleeve of the same type of construction with a draw string at the bottom. The operator places the casettes and film boxes in the dark room, pulls the sleeve over his head, and ties the draw string tightly about his waist. After waiting until his eyes have become accommodated, so that he will be sure there are no light leaks, he then loads or unloads the casettes. The exposed films are packaged and taken to the office to be developed.

This dark room is very satisfactory in a subdued light, i.e., in an ordinary office with the shades drawn and the lights out. For use in bright daylight a heavier or more dense material such as the rubber-backed cottons used in the manufacture of raincoats may be used.

This dark room is truly portable. Its total weight, including the supporting rods and carrying case, is seven pounds. When dismounted and rolled up it forms a loose roll six inches in diameter and 14 inches long. With telescoping or folding rods the entire dark room fits into a small zipper bag nine inches high, six inches wide and 16 inches long. Complete with carrying case, its cost is $25.

New Books

Review by

Walter D. Ludlum, Jr., M.D.,
New York City

INDUSTRIAL SURGERY, Principles, Problems, and Practice, by Willis W. Lasher, M.D., F.A.C.S., Surgical Director, Employers Liability Assurance Corporation, Assistant Professor, Traumatic Surgery, New York Post-Graduate Medical School; with a Foreword by Chas. Gordon Heyd, M.D., Past President, American Medical Association. Paul B. Hoeber, Inc., New York City. Price, $6.00.

INDUSTRIAL SURGERY presents concisely and graphically, the entire breadth of this rapidly advancing specialty. Its form is handy, its content accessible, its style simple, unaffected, conversational. The author uses effectively the illustrative case. Pages of theoretical discussion are obviated through searching analysis of actual case progress. All important aspects of the principle traumata are summated through detailed study of case series. Diagrams, sketches and x-ray prints are numerous.

Dr. Willis W. Lasher, the author, emphasizes that the practice of surgery in industry requires special aptitudes and careful training. Through a long and active career in this field, a career spanning the development of the specialty, he has had an opportunity to evaluate the numerous trends and conflicts which inevitably crop out in any new endeavor. Through directorship of a leading insurance company handling compensation and liability cases, his vast personal experience has been amplified by observation of thousands of cases cared for by fellow surgeons. This background accounts for the well-balanced and conservative views expressed on many controversial subjects.

Two preliminary chapters describe Medical Department organization and equipment. In medical personnel, the part-time system is contrasted with the full-time. Relations with employer, employee and with family physician are considered. Actual surgery is then studied by regions. Joint injuries are particularly well covered. The author is evidently specially interested in, and has made many original observations in, this field. Very illuminating are references through the text of reserves required to cover each type of injury.

Similarly, at the end of chapters, schedule losses are indicated.

This volume will prove most valuable to those practicing traumatic surgery both in industry and in private practice. The experienced surgeon will doubtless find it more stimulating and challenging than the aspiring beginner.

Congress of Physical Therapy

THE 17th annual scientific and clinical session of the American Congress of Physical Therapy will be held cooperatively with the 22nd annual convention of the American Occupational Therapy Association, September 12, 13, 14, and 15, 1938, at the Palmer House, Chicago. Preceding these sessions, the Congress will conduct an intensive instruction seminar in physical therapy for physicians and technicians—September 7, 8, 9, 10.

The convention proper will have numerous special program features, a variety of papers and addresses, clinical conferences, round table talks, and extensive scientific and technical exhibits.

The instruction seminar should prove of unusual interest to everyone interested in the fundamentals and in the newer advances in physical therapy. The faculty will be comprised of experienced teachers and clinicians; every subject in the physical therapy field will be covered. Information concerning the convention and the instruction seminar may be obtained by addressing: The American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago.

The Indiana Plan

IN INDIANA we have visualized preventive medicine as a wheel with each spoke representing some important phase.* Each phase is featured as a "Topic of the Month" in the *Journal of the Indiana State Medical Association* and is announced or discussed in each county medical society the month the subject is featured. The topic of the month is given support in the press and is discussed before medical and lay groups.

January—Formulation of Plan.
February—Syphilis.
March—Pneumonia.
April—Diphtheria.
May—Maternal and Child Health.
June—Crippled Children.
July—Highway Accidents.
August—*Occupational Diseases.*
September—Annual Physical Examinations and Heart Disease.

Occupational diseases form approximately 2% of the total disability from industrial causes.

1. Assist employers to cope with employees' health problems with cooperative attitude on the part of the medical profession.
2. Pre-employment thorough physical examination.
3. Periodic health examination. (If routine blood tests are made on the employees, treat—don't fire.)
4. Majority of occupational diseases are skin infections, many of which are preventable.
5. Patch testing of employees in occupations producing dermatitis will greatly decrease illness.
6. Teamwork of industrial physician and general practitioner is very desirable.
7. Industrial physician should direct patients with diseases other than those resulting from employment into the channels of ordinary practice.
8. Find the job that best fits the employee physically.
9. Use existing hospital facilities as much as possible.

* From *J.A.M.A.*, July 2, 1938, pp. 49 and 51.

Railway Surgeons' Congress

—Forty-Ninth Annual Meeting: Chicago. September 19, 20, and 21, 1938—

THE Program for the Forty-Ninth Congress of Railway Surgeons is tentatively outlined as follows:

Monday, September 19:

"Amputation Stumps of Lower Extremity," by R. HOUSEHOLDER, M.D.

"The Surgery of Peptic Ulcer," by HOWARD K. GRAY, M.D.

"Diagnosis of Acute Abdominal Pain," by H. IVAN SIPPY, M.D.

"Relation of Dental Pathology to Remote Body Pain," by ROBERT L. LADD, M.D.

"The Neurological Component of a Physical Examination," by LEWIS J. POLLOCK, M.D.

"The Relation between Arthritis and Injury and Injury and Arthritis," by PAUL B. MAGNUSON, M.D.

"Interesting X-Ray Problems," by HOLLIS E. POTTER, M.D.

"Transportation and Treatment of Fractures," by JOHN R. NILSSON, M.D.

Tuesday, September 20:

"Clinical Aspects of Cardiovascular Disease," by ROY W. SCOTT, M.D.

"Hyperparathyroid Disease and Manifestations of Interest to Industry," by EDWARD P. HELLER, M.D.

"Lumbar Vertebral Fractures, Non-Operative Treatment," by B. V. MCCLANAHAN, M.D.

"The Surgical Treatment of Bronchiectasis," by JOHN M. DORSEY, M.D.

"Appendicitis," by J. W. BARKSDALE, M.D.

"Mental and Emotional Instability, a Problem of Late Mid-life," by GEORGE T. HARDING, M.D.

"Trauma of the Larynx," PROFESSOR CHEVALIER JACKSON, and PROFESSOR CHEVALIER L. JACKSON.

Wednesday, September 21:

"Bone Traction Splint for Fractures of the Humerus," by T. VAN BOYD, M.D.

"Nerve and Muscle Injuries," DEAN LEWIS, M.D.

"Pneumonia in Industry," G. F. O'BRIEN, M.D.

"Plastic Surgery," by VILRAY P. BLAIR, M.D.

"Injuries and Tumors of the Spinal Cord," by WALTER E. DANDY, M.D.

"Surgery of the Colon," by VERNON DAVID, M.D.

Industrial Medicine

Reg. U. S. Pat. Off.

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VOLUME 7 AUGUST, 1938 NUMBER 8

"Drs. Arnold & Cummings"

THE announced government proceedings against the A.M.A. could be taken more seriously if they had not been given to the newspapers before they were given to the grand jury. Perhaps, however, it is just as well that they were thus made an administration "trial baloon," for the public is now hearing so much about ethics and standards in press comments and editorials as to bring the issues into clearer focus than would be possible with less publicity. From a survey of the general reaction, at the end of a week since the government's declaration of intention, the sentiment seems already in the majority, and still growing, to the effect that (1) the proceedings have a different purpose from the one alleged; (2) the A.M.A. is very likely to give such a good account of itself as will be the *reductio ad absurdum* of this kind of round-about procedure against it; and (3) the proceeding is poorly grounded: in *law*, since the practice of medicine isn't a "trade;" in *fact*, since the "monopoly," if there is one, lies in the initial right to practice medicine, rather than in the right to insist that it be practiced according to ethical standards; and in *judgment*, since there are numerous, and powerful, organizations, of many different kinds, that will perforce be enlisted with the defense from the very nature of their purposes and composition.

Meanwhile, some of the press comments are interesting. Among these is the indirect one contained in a review by Sterling North of Dr. Arthur E. Hertzler's new book, "The Horse and Buggy Doctor." Mr. North says:

"At a time when social planners with the best of intentions are preparing the way for cooperative or state medicine, it might be well to consider the career of Dr. Arthur E. Hertzler. If there are half a dozen men as intelligent, self-sacrificing and conscientious in the A. M. A. (and of course there are hundreds) perhaps the politicians would be wise to let the doctors do their own housecleaning.

"Somehow one can't see Homer S. Cummings and Mike Igoe driving 20 miles through a Kansas blizzard to operate by lamplight on a kitchen table, particularly if Mike and Homer knew in advance there would be no newspaper photographers present and the patient wouldn't pay when he got well.

"Thurman Arnold, America's No. 1 physician-baiter, who did a beautiful job of kidding-on-the-square in his 'The Folklore of Capitalism,' probably knows less about the folklore of medicine. Almost certainly he has never changed six tires on a primitive automobile on the way to an emergency appendectomy, fought his way through floods and snowstorms or battled vicious farm dogs at midnight.

"If Drs. Arnold, Cummings and Igoe have studied social pathology with the intense curiosity, the unflagging diligence and the lifelong devotion with which Dr. Arthur Hertzler has studied surgical pathology they may be ready to operate on the A.M.A. But something tells us that they still can't tell the patient's adenoids from his gall-bladder and are likely to cut his throat instead of his tonsils.

"It might be added that, when the politicians have devoted as much time, effort and self-sacrifice to the good of humanity as the uncomplaining country doctor (whose account books show he 'socialized' medicine decades ago)—when, in fact, the politicians have stopped kissing babies and have started nursing them through diphtheria, then the public may put some faith in their medical trust-busting activities.

"Dr. Hertzler's only allusion to this ever-recurring controversy is his statement that forward steps in the medical profession always are pioneered by the doctors themselves. But his career offers much food for moral pondering. Just how a doctor could have been more useful to his neighborhood and to humanity under any conceivable system, this reviewer does not know. . . . This country doctor has seen life and death. He makes you respect the one and keeps you from fearing the other. His sort cannot be improved upon by the Homer Cummingses and Mike Igoes of this world."

Another comment, direct and forceful, by Paul Leach has this paragraph:

"While members of the American Medical Association as well as state and municipal societies have for years been working with and encouraging group medicine, especially that financed by industries, the Washington doctors who have kicked up the fuss say there is all the difference in the world between that sort of group medicine and socialization by the federal government."

INDUSTRIAL HEALTH AND DISEASE

Industrial Medicine of Tomorrow

—Chairman's Address—*

ROBERT T. LEGGE, M.D.
Berkeley, California

WHEN medicine was superimposed on the employment relation in industry, it became a target for condemnation among the organized medical profession. Our medical societies took the stand that industrial medicine was contract or corporate medicine, and any physician or surgeon who became so engaged in this field suffered a stigma that was unjustifiable.

It is true that, in the past, poorly trained men unable to compete in general practice sought and accepted jobs as company doctors to do first aid and traumatic surgery, with the purpose of developing a practice among the worker and his family. Abuses due to exploitation, combined with poor and unscientific curative medicine, were practiced. For that matter such practices were not unknown in competitive medicine. All we have to do is to look back four decades in the practice of medicine and compare our training in the medical schools, good or bad, our hospitals with the hospitals of those days, the health officers of the counties and the empirical specialists of the period, for a telling and significant contrast.

As class A medical education advanced, with the imposition of a prescribed pre-medical university course, the tremendous discoveries in basic medical sciences, bedside clinical teaching and required internships, our medical graduates became the highly trained practitioners of the type now engaged in industry.

The methods of modern curative medicine inevitably developed the specialist, group medicine, the approved hospital and better organization of preventive medicine, so that today preventive medicine has been elevated to a pre-eminent place, having produced medical, sociologic and engineering scientists who are endeavoring to prevent the diseases curative medicine had previously relieved. As the result of research and clinical experience, much progress has been made in the science of nutrition, in health education, and in mental and industrial hygiene in the field of public health.

As progress continues, with new inventions and chemical and physical discoveries, there develops always a new order of conditions and new problems affecting human physiology, which must be met.

The modern well trained health officer whose essential vocation is in the realm of sanitation, vital statistics, epidemiology and all applied sciences in the field of public health cannot remain indifferent to those things which modern research in curative and preventive medicine is effectively discovering and producing. If rickets, for example, can be prevented by school nutrition, sunshine and open air classrooms, is not this his job?

Not a medical man in the world would openly advocate that the prevalence of typhoid or diphtheria should not be controlled because such procedure would reduce his income and practice, although such is really the case.

The profession must not be deluded into thinking that the educated layman is ignorant of medicine and public health. It took a member of the American Association for Labor Legislation to secure a federal legislative enactment to prohibit the manufacture of phosphorus matches—not the medical profession—to prevent phossy jaw among the workers. Likewise the workmen's compensation laws were created by laymen to promote better medical care for workers and to compensate them for their injuries and loss of wages. Their success was attained in spite of the opposition of the legal and medical professions. The passage of these laws in all the states of the Union resulted in the installation of safety measures and a consequent large reduction in accidents. The industrialists and the workers alike would not consider the repeal of these welfare measures, and neither would the medical profession. Wherever industrial medicine has been introduced in the modern factory, it has continued.

According to a recent paper, "In our industrial country, where 50,000,000 workers are gainfully engaged, it is only quite recently that the medical and public health authorities have taken an interest in occupational diseases. The tremendous advancement in knowledge of physical and synthetic chemistry in the past two decades has developed useful discoveries, which have brought about social and industrial changes almost revolutionary and have likewise produced a train of industrial and domestic hazards of corresponding significance. Every new process, improvement or discovery presents some new danger, so much so that today occupational hazards exist in four out of five trades." Forty years ago Osler's Practice of Medicine listed one occupational disease, lead poisoning, while today Cecil lists only 10.

The old-time factory doctor treated many symptoms, such as dyspnea, numbness, nausea or headache, as conditions arising from some functional or bacterial origin, while the modern well trained industrial physician recognizes that these are frequently the prodromal signs of a toxic element due to environmental labor conditions in which a special chemical is used. These call for preventive measures, the substitution of nontoxic agents, removal of workers from the atmosphere, introduction of forced ventilation, and so on.

Industrial physicians recognized these early and late occupational diseases at their respective industries, and with the cooperation of chemists, engineers and the industrialists themselves, occupational diseases are being studied and controlled, while absenteeism and compensations are being minimized.

Some years ago the American Association of Industrial Physicians and Surgeons was organized, a group of men of great ability engaged in the important industries of the country. These observers visualized the idea that, to humanize industry, preventive medicine and safety were their main objectives. They had witnessed the disabling injuries and degenerative occupational diseases, and as a result a new era in plant sanitation, safety measures, better working conditions, health education and factory inspection was introduced.

We are indebted to these factory physicians for our knowledge of industrial accidents and diseases, developed through their scientific studies and observations. They promoted safety measures which reduced traumatic injuries two-thirds and incidentally reduced unnecessary compensation and suffering, whereby both the employee and the employer profited. When traumatisms occurred they were seen at once and shock, hemorrhage and infection arrested, thereby preventing possible ankylosis, deformities and amputations and rendering hospitalization and the service of specialists unnecessary. This is preventive surgery. The modern industrialist, the man who pays the bills, knows that such an industrial service means lessened expense to himself, his employee and the community. Therefore it becomes necessary in the practice of curative medi-

* Read before the Section on Preventive and Industrial Medicine and Public Health at the Eighty-Ninth Annual Session of the American Medical Association, San Francisco, June 15, 1938; published in *J.A.M.A.*, July 23, 1938.

cine to have a well equipped health center, with laboratory and trained personnel, located at the plant, to care for immediate emergencies and minor illnesses, the ultimate purpose being to record symptoms and study the factors that produce them and to prevent occupational diseases and grave morbidity by treating cases early.

Careful physical examinations should be conducted at the time of employment, thus offering the physician a recorded health picture of the employee. Defects found should be noted and the applicant informed for correction by his physician. At this time the applicant should be placed on a job suited to his adaptability. One of the foremost benefits derived from an industrial clinic is due to the rule that employees report whenever any early symptoms appear, as these manifestations may be of definite industrial hazards, worthy of medical differentiation. Many diagnoses of characteristic occupational diseases are thus determined.

To illustrate this point: Dr. Gerhardt of the Dupont Company, where tetra-ethyl lead is manufactured, noted by close observation that those workers who had lost their appetite for breakfast or whose sleep was disturbed by dreams presented earlier signs of lead poisoning than those with the classic signs as described in the textbook, such as anemia, basophilia or the lead line.

When plant physicians can observe and treat such medical cases while in the early stages and before pathologic changes ensue, morbidity and mortality will be greatly curtailed.

Employers demand that the plant physician be able to differentiate definitely between compensable and non-compensable diseases. Certainly he must be more proficient in this field than the health officer or the general practitioner. And here again the question arises as to why our medical schools devote so little time to teaching and training in industrial medicine.

Every state board of health should have a division of industrial hygiene where the small plant employer and the medical profession can secure advice and information for the solution of perplexing problems.

We physicians in general practice should not be misled by the notion that toxic hazards responsible for many occupational diseases are primarily confined to industry. This chemical age has ventured into warfare, agriculture and the modern home as well. Thus the medical profession is obliged to think in terms of occupational disease due to some toxic agent, in considering every obscure medical case not the result of an infectious organism. Thus it is necessary, in examining every patient, to inquire what his occupation is and whether there is any toxic agent prevalent in his environment. My purpose in this digression is to encourage occupational disease diagnoses and reporting them to health

THE AMERICAN ASSOCIATION

of

INDUSTRIAL PHYSICIANS and SURGEONS

Component Societies

Central States Society of Industrial Medicine & Surgery

Association for the Advancement of Industrial Medicine & Surgery

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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boards so as to promote prevention and worthy claims for compensation.

For the past two decades the American Association of Industrial Physicians and Surgeons, American Labor Association, the League of Nations programs, the United States Public Health Division of Industrial Hygiene, the National Safety Council, railroad surgeons and others, have advanced, by research and clinical studies, methods to detect and prevent industrial diseases. The number of traumatic injuries and burns have been greatly minimized by these studies. During this period of American industrial medicine, Harvard University instituted a graduate school in industrial hygiene, leading to a doctor's degree. Two able journals devoted to research and practical industrial medicine are published.

The American Public Health Association recognized many years ago that industrial hygiene and medicine was a public health activity of major importance. It organized a section in this field and established important committees on special hazards, which have contributed much research on industrial diseases, publishing several classic reports on toxic metals and solvents.

The American College of Surgeons in 1926 developed as one of its main activities a minimum standard for medical services in industry. To be included on the approved list a careful investigation of the plant is conducted, the requirements being that the plant support an organized medical service with competent physicians and consultants and an adequate health service with proper emergency facilities for physical examinations and efficient care for all industrial injuries and illnesses sustained while on duty. Practical plant sanitation and other health measures to benefit the employees are also required. The college demands a system of accurate and complete records of illnesses and injuries and that major cases be sent to approved hospitals. The American College of Surgeons maintains a section in industrial medicine at the annual clinical congress, which has promoted greatly improved methods in the treatment of fractures.

Last May the Midwest Conference on Occupational Diseases held a three-day session in Detroit, and this year the eighth International Congress on Industrial Diseases and Accidents convenes at Frankfort on the Main, emphasizing the importance of industrial medicine and hygiene in the world of industry.

The American Medical Association took a rather conservative or possibly badly advised attitude toward early recognition of the importance of industrial medicine. It was even late in developing a dual section for preventive medicine and public health, a section which now includes industrial medicine. At the meeting of the Association at Kansas City, a resolution was introduced in the House of Delegates calling attention to the in-

creased recognition of the seriousness of diseases arising from conditions to which workers are exposed in certain occupations, and a request was made that the Board of Trustees enlarge its study of industrial diseases. The House of Delegates after conference with group industrial, medical and public health specialists recommended that a new Council on Industrial Health be organized and for that purpose selected nine men to serve as members. The Association, through its new Council of Industrial Health, now has its greatest opportunity to be a benefactor to American industrial medicine; to promote by research and uplift by education and mutual cooperation the humanizing of industry by preventive medicine. Its aim should be not only a whole-hearted program in the study and prevention of occupational diseases but also to strengthen a loyal cooperative spirit to support medical practitioners who are so engaged. It must stimulate the consciousness of all industrialists to the need for the application of modern industrial medicine entailing the service of competent physicians and the development of standardized health services in which preventive medicine and surgery as they have been outlined in this address will be scientifically practiced.

The fear that industry desires to engage in so-called corporate medicine is shared by some; while it is true that the organization of medical protection in a plant contributes to the cost of the service by necessity, it also involves vital interests in the prevention of disease and avoidable accidents. The new Council on Health must not fail in the new order of medicine. It has the opportunity, with the greatest group of our population, the worker and the industrialist, to forestall a political form of medicine which the organized profession is not in sympathy with. It can, besides educating employers to the necessity of medical supervision of their plants, promote a standardized system of industrial medicine suitable for both small and great plants, stress ideal plans, and certificate such plants as conform to the requirements.

Our Association can do much by devising simple tests for the recognition of toxic substances and encouraging chemists to develop non-poisonous substitutes. Knowledge of the early signs of occupational diseases should be increased by instituting in our medical curriculums a course in industrial hygiene and toxicology and by devoting special space in *The Journal* to industrial health problems. It can also do much to popularize the idea of how profitable to both employer and employee is the maintenance of an efficient health service in their plants in promoting efficiency and the reduction of absenteeism due to illness and accidents, and in the establishment of periodic physical examinations with scientific first aid medicine and surgery.

The Industrial Doctor

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INDUSTRIAL MEDICINE

540 North Michigan Avenue, Chicago

Industry and organized labor have pointed the way and will look to the American Medical Association to cooperate in advancing industrial medicine and not to oppose it. Modernized ethics provide for the administration of minor curative and major preventive medicine so necessary to meet the just demands for the control of occupational diseases and accidents.

Some one has said "Preventive medicine dreams of a time when there shall be no unnecessary suffering and no premature deaths, when the welfare of the people shall replace greed and selfishness, and it dreams that all these things will be accomplished through the wisdom of man." Truly, these are the objectives.

Hernia Problems and the Industrial Commission

ONE of the most aggravating medical problems arising under the Workmen's Compensation Act is that involving traumatic hernia.* It causes the Commission more grief and opens the gate to more arguments than almost any other single question coming before that department.

In the first place, there is delay in adjudicating such cases because they require careful and usually extensive investigation from a legal standpoint. Many "traumatic" hernias are found after thorough investigation not to be the result of an accident as defined by the Workmen's Compensation Act and for that reason are not compensable.

Secondly, there is delay in some instances on the part of the Commission in granting permission to surgeons to operate on hernia cases after the case has been given a clean bill of health legally speaking. There seems to be little or no excuse for this delay. However, it must be borne in mind that the Commission is confronted with numerous complicated problems and that its routine is enormous, making it impossible for it to function as rapidly as desirable in some instances.

In the third place, some physicians maintain an arbitrary attitude with respect to hernia cases which makes prompt adjudication impossible and deprives the patient of immediate and necessary medical care.

For example, occasionally a physician insists that a certain case of hernia is "traumatic" in origin in the face of conclusive evidence that the hernia had been present for a long period of time. Out of consideration for the physician, the legal department of the Commission is forced to make an extended investigation before a final decision rejecting the claim can be made.

Here is another situation which causes difficulty: Some physicians insist on having written permission from the Commission to operate be-

* From "In Our Opinion," *Ohio State M.J.*, July, 1938.

fore operating, although immediate operation is indicated. Obviously, before the Commission can give written permission to operate it must have the approval of the legal department to the effect that the claim is compensable. This means investigation and delay.

The practice followed by some surgeons would seem to be the desirable one. When they have decided that a hernia case needs immediate surgical attention, they operate and then let the case take its natural course through the Commission. If the case is *allowed*, the surgeon is paid by the Commission for his services. If the case is *disallowed*, the surgeon must look to the claimant for his fee. In any event, the patient has received the care which he needed and the surgeon is no worse off than he would have been had the patient not been employed at the time of the emergency. This would appear to be the sound procedure, medically and professionally.

Some of the difficulty with respect to hernia cases can be alleviated, if the Commission will make an effort to speed up investigations and all physicians will take a sensible attitude in handling such cases.

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